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ESSEX FIELD CLUB,

EDITED BY

WILLIAM COLE, F.L.S., F.E.S.,

Honorary Secretary and Curator.

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The Authors alone are responsible for the statements and opinions contained in their respective papers.

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The Recording and Preservation of examples of the Folk-Songs and Dialect of Essex and East Anglia.

The statement on the wrapper of the July part of the ESSEX NATURALIST has aroused considerable attention, and I have received promises of help. Some experienced musicians and experimenters have also given valuable advice. Local societies have been induced to take up the subject, and I am hopeful that an important East Anglian organisation will actively co-operate in our own district.

A few experiments carried on during last autumn fully demonstrated the practicability of recording accurately local songs and dialect "pieces" by the phonograph, and we anticipate making substantial progress during the ensuing summer and autumn. Perhaps some of our fellow-members will aid in the way indicated in the first notice.

I hope to be in a position to announce details of the proposed Committee and its work in the near future.

WILLIAM COLE.

THE ESSEX MUSEUM OF NAT. HIST.,
ROMFORD ROAD,
STRATFORD, ESSEX.

February, 1907.

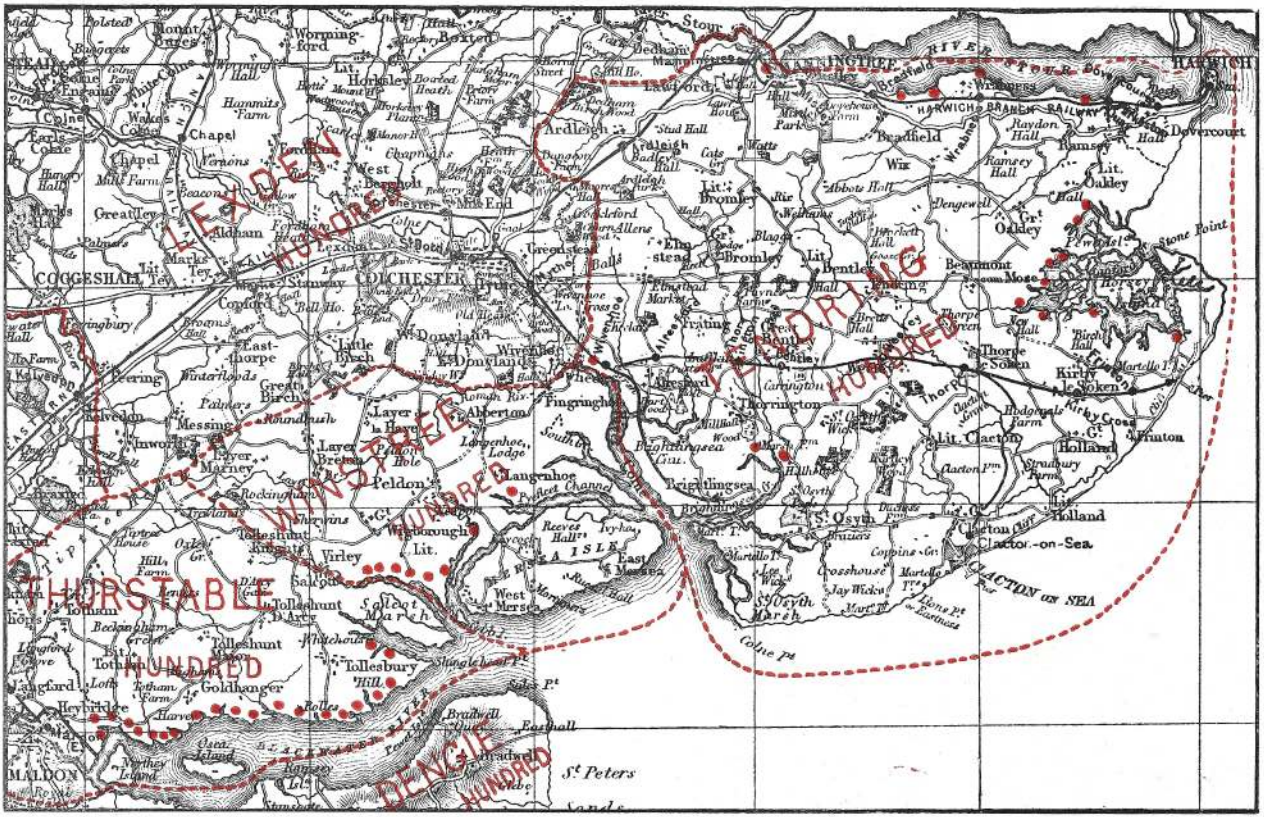

FIG. 1.—MAP OF THE NORTHERN HALF OF THE ESSEX COAST, SHOWING APPROXIMATELY THE SITES OF THE FORTY-FIVE ESSEX SALT-PANS MENTIONED IN DOMESDAY BOOK (1086).

A HISTORY OF SALT-MAKING IN ESSEX.

By MILLER CHRISTY, F.L.S., *President E.F.C.*

(*With Plates xxx, xxxi, and xxxii*).

[*Read 7th April* 1906].

THE English salt-manufacturing industry has been concentrated so long and so completely in the rock-salt districts of Cheshire and Worcestershire that it is practically extinct everywhere else in Britain. It will be news, therefore, to most people—even to Essex people—that salt is still made in Essex. And not only is this the case, but the industry is one of the very oldest now existing in the county. There is clear documentary evidence that it has been carried on here continuously since the time of King Edward the Confessor (1041-1066), nearly a thousand years ago, and there can be little or no doubt that it is really very much older. It seems probable that the industry originated in Essex before the time of the Romans. In any case, it had become of considerable importance in Saxon days. By Norman times, it had grown to a large industry—at least as important, probably, as in any other English county, except, perhaps, Sussex; and it continued to be of great importance with us right through the Middle Ages and modern times, down to about a century ago, when it declined greatly. At the present time, it is carried on at only one small, though prosperous, establishment. It is of the history of this very ancient, interesting, and necessary industry that I propose to treat in what follows.

Salt-making, like many of our more ancient industries, has left a record of its former prevalence in the county in our modern place and field names. In the first place, the industry has given name to one of our Essex parishes—namely Salcot, at the head of Salcot Creek—in which, undoubtedly, there once existed (as in not a few adjacent parishes) at least one "salt-cote"[1] at which salt was made. Then, again, in the parishes which abut upon the many creeks, estuaries, and inlets on our coast, there are not a few fields called by names which show that salt-works formerly existed in them.[2] Such are "East Salts" in Great

1 The *New English Dictionary* defines a "salt-cote" as "a place where salt was wont to be made on the sea-shore." Originally, no doubt, it was the small shed or "cote" in which the manufacture was carried on. "Cote" appears frequently in English, meaning a small building used as a residence ("cot" or "cottage"), or as a shelter for small animals ("dove-cote" or "sheep-cote"), or for making or housing anything ("peat-cote" or "salt-cote").

2 See Mr. W. C. Waller's "List of Essex Field Names" in *Trans. Essex Archæol. Soc.*, n.s., vol. v., p. 174; vi., pp. 79 and 273; vii., pp. 87 and 319; viii., p. 200, and ix., p. 267. The extensive "saltings" round our coast have, of course, no connection with salt-making.

Wakering, "Home Salt-coats" in Stow Maries, "Salcote-stone Field" in Tollesbury, "Salcots" in Brightlingsea, "Salt-acre Marsh" in East Mersea, "Salt-coat Marsh" in Burnham, "Salt-bridge Field" in Eastwood, "Salt-bridge Field" in Rochford, "Salt-pan Marsh" in Paglesham, "Salt-reach Field" in Eastwood, and "Salts" in Barking. Less easy of explanation are "Salt Acre" in Roydon, "Salt Field" in High Easter, and "Salt Pasture" in Bocking. These are all inland, and were named, perhaps, after some saline excrescence noticed in them. "Salt-box Field" in Waltham Holy Cross was probably so-called from its shape. "Salter's Field" and "Salter's Ten-acres" in Great Oakley commemorate, beyond doubt, the making of salt at that place. "Salter's Piece," in Sible Hedingham, lying far inland, takes its name probably from some former owner named Salter, who, however, must have derived that name from the fact that one of his ancestors followed the occupation of a "salter" or salt-maker. It is worth noting, too, that the inn-sign of the "Three Cups" (generally spoken of as the "Cups"), representing the armorial bearings of the Salters' Company[3], still occurs five times in Essex—at Harwich, Great Oakley, Colchester, Maldon, and Springfield. Two of the houses bearing the sign are still large and well-known hotels, and all, except the last-named, are situated either actually on or close to that portion of our coast on which salt was made largely. Moreover, in 1777, according to Chapman and André's map, there was a sixth house bearing this sign at Manningtree—another Essex town at which salt was made at the time. Clearly, therefore, the sign is with us a relic of the industry.

The kind of salt made in Essex in early times was that known formerly as "bay salt"—that is, salt made by evaporating sea-water in shallow pans by means of sun-heat.[4] The process, though successful in hot countries further south, must have been very tedious in our climate. Yet there can be no doubt that, during summer, salt could be made, and was made, by this means in Essex. The sea-water was let into large shallow ponds, where it remained until more or less reduced and

3 Per chevron, azure and gules; three-covered sprinkling-salts argent, sprinkling salt proper.

4 It was so called because it come originally from "La Baye" (of Biscay), round the shores of which there were many salt-evaporating pans.

concentrated by evaporation. The resulting brine was then further reduced and the salt crystallised by artificial heat.

The salt made here in later times (including the present) has been that known as " white salt "—that is, salt made by boiling sea-water by means of artificial heat. This latter process is now carried on nowhere in England (so far as I am aware), except at our one remaining salt factory, having been superseded everywhere else by the making of salt from rock-salt.

It seems probable that our Essex coast offers greater facilities for making salt from sea-water than any other part of the coast of England. In the first place, we have many extensive, shallow, narrow-mouthed estuaries, creeks, and inlets of the sea —together, probably, far larger, both in number and in area, than those of any other county. It is easy to understand that salt in large quantities must be deposited by evaporation on the extensive mud-flats and saltings which exist in and around these inlets, and that this salt must be taken up in solution and re-deposited, again and again, by each tide—twice, in fact, in every twenty-four hours—till the water becomes exceptionally salt. Further, these inlets lie on the east coast, where the rainfall is far less than on the west, and the water in them is likely, in consequence, to be less diluted by rain and river-water than the water in similar inlets lying on other coasts where the rainfall is greater. This comparatively-light rainfall and the extent, shallowness, and narrowness of our estuaries and inlets seem likely to cause the water in them to be of higher salinity than the water of other English inlets of the kind. It would be interesting if some of our chemical members would conduct experiments with a view to showing whether this is so or not, and, if so, to what extent.

However this may be, nearly all our Essex salt-works were situated, not on the open sea-coast, but on the shores of estuaries and inlets, and generally near their heads. Further, in Norman times (as will be seen from what follows), salt-pans were thickest around those inlets of the sea (as Hamford Water, The Ray, Salcot Creek, and Tollesbury Creek) which were *inlets merely*: not river estuaries. In these, probably, the water is of even higher salinity than that in the estuaries, as it is not diluted by river water. This is, no doubt, especially the case with Hamford Water, which is of very considerable extent, while its mouth is

very narrow and no river of any kind flows into it. At all events, there were many salt-pans round its shores in early days.

That the Romans made salt on our Essex coast is extremely probable, but I know of no actual evidence.[5] That the Saxons did so is certain; for not a few of the salt-pans mentioned in Domesday Book are stated to have been in existence in the days of King Edward the Confessor.

By the time of the Normans, salt-making was a considerable industry upon our coast, and some forty-six salt-pans (*salinæ*) are mentioned in the returns of the Great Domesday Survey made in 1086.[6] All of these (with one exception) were situate on the northern half of our coast-line, in the Hundreds of Tendring, Winstree, and Thurstable, as shown on the accompanying map (Plate xxx).

In Tendring Hundred, there were seventeen salt-pans, three of which (and one other which was disused) had existed in the time of the Confessor. Lawford, Wrabness, Ramsey, Great Bentley, Thorrington, and Elmstead had one each; Bradfield, Great Oakley, Beaumont, and the three Sokens jointly had two each; while Moze had three. Several of these parishes and others which follow lay mainly inland and scarcely touched the salt water, as will be seen on reference to a map. Of these seventeen pans, it will be found that five were situated on the south bank of the Stour Estuary; nine round the shores of Hamford Water; and the remaining three on the north side of the Colne Estuary.

In Winstree Hundred, further south, there were eight salt-pans, none of which are stated specifically to have existed in the time of the Confessor. Of these eight pans, Peldon and Langenhoe (both on the channel separating Mersea Island from the mainland) had one each and Great Wigborough (near the head of Salcot Creek) had no less than six. In this Hundred, too, is the manor or parish of Salcot, which must have derived its name from salt-cotes which existed there in Saxon times, for none remained at the time of the Great Survey.

5 The late Canon J. C. Atkinson considered (see *Archæol. Journ.*, xxxvii., pp. 196-199; also *Essex Review*, iii., pp. 276-277) that our "Salting-mounds" or "Red-hills" (which are probably older than Roman times) were the sites of old salt-works. Others have held the same view, but the evidence available so far does not suffice to enable us to decide of what ancient industry these mysterious mounds are a relic.

6 These were first studied by Dr. J. Horace Round (*Victoria Hist. of Essex*, i., pp. 380-382), to whose remarks on the subject I am much indebted.

In Thurstable Hundred, lying still further south, on the north bank of the Blackwater Estuary, there were no fewer than twenty salt-pans and one-half, of which three-and-one-half (and seven others which had disappeared) had existed in the time of the Confessor. Tolleshunt D'Arcy, Tolleshunt Major, Layer Marney, and Heybridge had one each; Goldhanger had one-and-a-half;[7] Great Totham had two; Little Totham had three; while Tollesbury had six (five of these being in the manor of Tolleshunt Guisnes, where there had been no fewer than *twelve* pans in the time of the Confessor). Further, somewhere in this Hundred, the King had four pans, which were in charge of the Sheriff of the County. Most of these pans (probably about twelve of them) were on Tollesbury Creek (an inlet merely), and the remainder on the north side of the Blackwater Estuary.

The only other Essex salt-pan mentioned in Domesday Book was at the opposite extremity of the county, namely at Wanstead, in Becontree Hundred. The locality is not one in which a salt-pan might have been expected; yet the pan in question had existed since the time of King Edward the Confessor.[7A] Wanstead lies mainly upon the River Roding, but it is scarcely credible that salt-water can ever have come up that river thus far. In all probability, therefore, the salt-pan was in the semi-detached portion of the parish (some 38½ acres in extent) which abutted on the River Lea, and was connected with the rest of the parish by a long narrow strip, known as Wanstead "Slip" or "Water slip."[8] The right to this "Water-slip" was formerly guarded very jealously by the parish authorities, but later it became a source of trouble, and it has now been merged in adjacent parishes. In early days, the salt water may have come up the Lea to this point. The only other possible solution is that the so-called salt-pan was a salt refinery of some kind, but there is no evidence in support of this.[8A]

From the foregoing, it would appear that, in Norman times, salt-making in Essex was confined practically to the three Hundreds mentioned above (namely, Tendring, Winstree, and

7 The other moiety belonged, no doubt, to some other parish. The rights of the two parishes were satisfied, probably, by dividing either the produce or the profits.

7A See *Victoria Hist. of Essex*, i, p. 438.

8 For this suggestion, I am indebted to the kindness of our Vice-President, Mr. Walter Crouch, of Wanstead.

8A As Professor Meldola has pointed out to me, a century ago there was a Salt's Green in or a little to the south of Leytonstone, but there is nothing to show that it had any connection with salt-making. It does not appear on modern maps.

Thurstable), which form the northern half of our coast-line. That this really was the case may be doubted. One cannot help thinking that many salt-pans must have existed in the four other Hundreds which form the southern half of our coast-line (namely, Dengie, Rochford, Barstable, and Chafford), but that, for some reason, they were not entered on the returns furnished by those who made the Great Domesday Survey.

At all events, it is certain that salt has been made, at some time or another, on this southern portion of our coast-line, as is proved by the field-names referred to above and other information given hereafter. In Dengie Hundred, on the north bank of the Crouch, there is still (as Dr. Laver has pointed out to me) a farm bearing the name of "Salt-coats," situated at the head of Clement's-Green Creek.[9] Further, Benton says[10] that "indications of old saltcotes or salt-pits" are to be found all along the south bank of the Crouch (in Rochford Hundred), from Hockley to Paglesham. In regard to Paglesham, Dr. Laver writes me as follows:—

"About 1820, when my father was tenant of East Hall, a marsh of thirteen acres, lying next the sea-wall and known as Salt-pan Marsh, was in grass. Its surface was very uneven, by reason of the large number of shallow ponds it contained—the pans in which sea-water had been evaporated formerly for salt-making. As my father wished to grow corn on it, he decided to level it, which he did during one winter by means of spade labour, thereby adding to the farm a most productive field. For many years after this, it was not uncommon for men working in the field to pick up small silver and copper coins—some, I believe, of the time of Charles II.: others, I fancy, earlier."

"I do not know when these salt-works ceased working; but there is evidence that they were in work so far back as the time of Queen Elizabeth. The materials of the store-houses were known to have been brought away after it fell into disuse and to have been used at East Hall in the erection of a barn, which was still standing in 1867. These timbers were of oak and were clearly of the age stated. Many of them retained grooves which had been intended to accommodate sliding window-shutters."

That salt-making continued to be a flourishing industry on the Essex coast throughout the Middle Ages is clear from the many references to it which occur in wills of the Fifteenth and Sixteenth Centuries.

Thus, in 1497, John Beriffe the Elder, merchant, of Brightlingsea, left, for the purchase of two bells for the parish

9 It is marked on Chapman and André's Map of Essex (1777)
10 *Hist. Rochford Hund.*, p. 286.

church, "one hundred marks which William Bounde and Robert Barlow owe me for one lot of salt."[11]

In 1501, Henry Boode, of Burnham, left his house to his wife, except "the berne [barn] in which my salte lyeth" and a new shop with an inner chamber in which more salt lay, and he directed that she was not to meddle with these until the salt was out of them.[12]

In 1547, John Creke, of Hockley, describing himself as a "weller" (by which, clearly, he meant a salt-boiler), left to his son Thomas his "salcotte and iiij ledds belonginge to the said salt house, with all other implements that a weller ought to have, but no salte."[13] By "ledds," Creke meant, no doubt, leaden evaporating pans. His salt cote must have been in that small part of Hockley which extends northwards and abuts upon the estuary of the River Crouch.

On Whit-Sunday in 1532, when the churchwardens of Heybridge made a "play" and a feast in their church, they paid two pence "for a pecke of whyte salte"—made, no doubt, in the vicinity.[14]

On 1 June 1567, one Edward Goodding wrote from Ipswich to Sir William Cecil:[15] "I trust to set the [salt-]house in Essex fullie on worke the nynthe of June at the furthest; and, upon one wick press made, I will await upon your honour."

The Rev. William Harrison, of Radwinter, writing in 1587, says[16] that "as wel the baie as white [salt] are wrought and made in England, and more white also upon the west coast, toward Scotland, in Essex, and elsewhere, but of the salt water."

Salt-making continued to flourish on our coast until the beginning of the Nineteenth Century, when it began to decline.

In or about 1710, when some bill relating to the salt trade was before Parliament, a return was made of the places at which salt was then made in England[17]; and from this it appears that, in Essex, salt was made or refined at Manningtree, Colchester,

11 Will dated 20 Jan. 1496-7, and proved 18 July 1497 (P.C.C., 10 Horne).
12 Will dated 20 Feb. and proved 20 April 1502 (P.P.C., 12 Moone).
13 Will dated 28 Mar. 1547 (Archd. Essex, 10 Bastwick, 100-101).
14 See Nichols' *Illustrations of the Manners and Expenses of Ancient Times* (1797), p. 181.
15 S.P.D., Eliz., xliii., no. 1.
16 See Holinshed's *Chronicles*, i., p. 241. In the earlier edition (1577) the words "in Essex and elsewhere" did not appear.
17 See copy in Brit. Mus. (816. m. 13, ff. 108 and 109).

and Maldon; at all of which places, the refiners used "water-borne" coal for boiling their brine-pans.

At Colchester, the industry continued until at least 1793, when John Buckingham was a "dealer in salt" there, and John Luff kept a "Salt Office."[18]

At Manningtree, the industry survived even later; for, in 1823, one James Monteith, residing there, was described[19] as a "salt-refiner and coal merchant."

In 1836, there were in England thirteen salt-works (or, rather, salt-refineries) making salt from rock-salt, using "sea water as a solvent." Of these, two are stated to have been in Essex—at Manningtree and Maldon.[20] Probably, however, it did not survive long at Manningtree.

At Maldon alone has the industry continued to the present day. That the town was formerly recognized generally as a centre of the salt-making trade is shown by the fact that, in 1785, a writer spoke[21] of the demand for "the famous Maldon salt," while in 1823 another described[22] Maldon as "famous for its salt." Yet it seems clear that much of the salt which passed as Maldon salt was made, in reality, in the adjacent parishes of Goldhanger and Heybridge, on the opposite side of the river.

In 1786, Morant wrote[23] that, at Goldhanger, there was a "a considerable salt-work, in which is used Rock-Salt brought from Cheshire, mixed with sea-water." This establishment was, apparently, still working at Goldhanger in 1819, when Cromwell wrote :—[24]

"The salt-works here are considerable. Rock-salt from Cheshire was formerly used; but, in consequence of the erection of very extensive works by Messrs. Bridges, Johnson, and Co., the manufactory of salt from the sea-water by steam has been practised with considerable success."

In all probability, Cromwell here confuses the "very extensive works" of the firm named (which appear to have been, in reality, in the adjoining parish of Heybridge: see *post*) with the earlier salt-works at Goldhanger.

In 1889, our Past-Presidents, Dr. Laver and Mr. E. A. Fitch,

18 See *Brit. Directory*, 1793, ii., pp. 522 and 523. The "Salt Works" at the Hythe are shown on Thomas Sparrow's *Survey of Colchester* (1767) and on Chapman and André's Map of Essex (1777).

19 *Pigot's Directory, 1823*, p. 299.

20 See *Rep. of Select Com. on Salt* (*British India*) (1836), p. 218.

21 See John Phillips, *Treatise on Inland Navigation* (1785), p. 18.

22 *Pigot's Directory, 1823*, p. 289.

23 *Hist. of Essex*, i., p. 389. See also the *Hist. of Essex*, by "a Gentleman," v (1772), p. 385.

24 *Excursions through Essex*, i, p. 41.

FIG. 2.—THE MALDON SALT-WORKS.
(*From a photograph by* MILLER CHRISTY.)

FIG. 3.—THE SETTLING-POND AT THE MALDON SALT-WORKS.
(*From a photograph by* MILLER CHRISTY.)

excavated the site of some old salt-works on Bound's Farm, Goldhanger (very likely those mentioned by Morant), and found extensive flues of brick, pipes and pans of lead, and some small coal which had been used, no doubt, for boiling the water. Dr. Laver has been good enough to give me the following information :—

" On arriving [he says], we found the men working in a field next to a grass marsh just inside the sea-wall. This grass marsh had in it various depressions, some of which might have been old salt-pans, but one had been, apparently, the bed of a small creek, of which there were much more distinct traces outside the sea-wall.

" In the ditch and bank of the field in which work was going on, and in the adjoining portion of a field to the east, we found the surface of the ground slightly raised, due to a thick superimposed stratum of burnt earth. In this red and black soil, trenches had laid bare the remains of the foundations of buildings ; and, as the trenches extended, the general ground-plan became more or less clear. I regret now that I did not go to the expense of having a plan drawn to scale, as this could have been done quite easily.

" At one place, there was a well about three feet square and three or four feet deep. It was lined with planking, which had been very well jointed, and had in it the remains of a wooden pump.

" Not far off was a small square building which had evidently contained the furnace ; and, close by it, in another small square building, there remained a hundredweight or two of very good coal, which looked exactly like the bright coal, known as " Wall's End," used years ago in the district.

" Near these, again, were some shallow brick tanks, clearly evaporating pans, about six feet long, three feet broad, and one foot deep. Their sides were formed of double layers of brick, containing flues leading from the furnace. Originally, no doubt, they were lined with lead, some pieces of which we found ; but, the flue being contained within the brickwork, the heat did not come into direct contact with the lead. From one of the tanks, a brick drain led to the well above mentioned.

" All these remains were covered by about three feet of the burnt red and black soil mentioned above. We came to the conclusion that this salt-cote had been destroyed by fire, and that the *debris* had been spread evenly over the whole site, covering the boiling house and everything else.

" We could find no clear evidence as to the exact date of construction of these works, but the size of the bricks used showed that the works had been built not later than Jacobean times."

The firm of Bridges, Johnson, and Co., of Heybridge, seems to have disappeared before 1823, when one John Bridges (who had been probably a member of it) owned " very extensive works " in Heybridge.[25] These works were situated on the sea-wall facing Collier's Reach, close to Heybridge " Basin," and on a marsh which is still called " Salt Court." Here are yet to

25 *Pigot's Directory, 1823*, p. 298.

be seen the ruins of extensive walls, built of shingle, bricks, and cement. Close at hand is a large salt-pan, about fifty yards square and still full of water, while traces of other pans may also be seen. Near the high road skirting the marsh is the store-house in which the manufactured salt was kept. It is now used as a malting. Local tradition says that the business carried on at these works never yielded a profit, and that they ceased working altogether on the abolition of the salt tax in 1825, a few years only after the buildings had been erected.[26] Indeed, the name of Bridges does not appear in *Pigot's Directory* for 1826.

At this time, however, one Robert Worraker, described[27] as a "salt-maker," was living at Heybridge, having, perhaps, bought Bridges' business. Later, either he or one of his descendants appears to have removed the works to near Full-bridge, at Maldon, on the opposite bank of the river. Here he carried on a small and dwindling business till 1882,[28] when, as the only alternative to closing the works altogether, he sold the whole concern to Mr. T. Elsey Bland, of Maldon. That gentleman has since carried on the business in the old works (Fig. 2 Pl. xxxi), with increasing success, trading as the Maldon Crystal Salt Company. The method of manufacture is as follows:—

At the top of the highest spring tides (unless there has been recent heavy rain), the salt water of the river is let into a small reservoir (Fig. 3, Pl. xxxi), some thirty-five feet square and fifteen feet deep, on the river bank. After sufficient time has been allowed for any sediment to settle, as much of the water as is required is pumped up into a large wooden tank, holding some 1,000 gallons, in which it is clarified by a simple process, the exact nature of which is not disclosed. This tank is in the works (shown in Fig. 2). After this, the water is run off into two large boiling-pans, each about ten feet square and a foot deep, in which it is again "fined" by a simple process. The fires which heat these pans are lighted every morning between seven and eight o'clock; and, in about three hours, the water begins to boil, but is not allowed to continue to do so for more than ten or fifteen minutes. It is kept hot, but not boiling, for about ten hours, and is then allowed to cool gradually, any impurities which rise to the surface being removed by means of

26 See Fitch, *Maldon and the River Blackwater* [1898], pp. 50-51.
27 *Pigot's Directory, 1826*, p. 544.
28 At the Census of 1871, four persons (all, no doubt, in Worraker's employ) were returned as engaged in salt-refining in Essex.

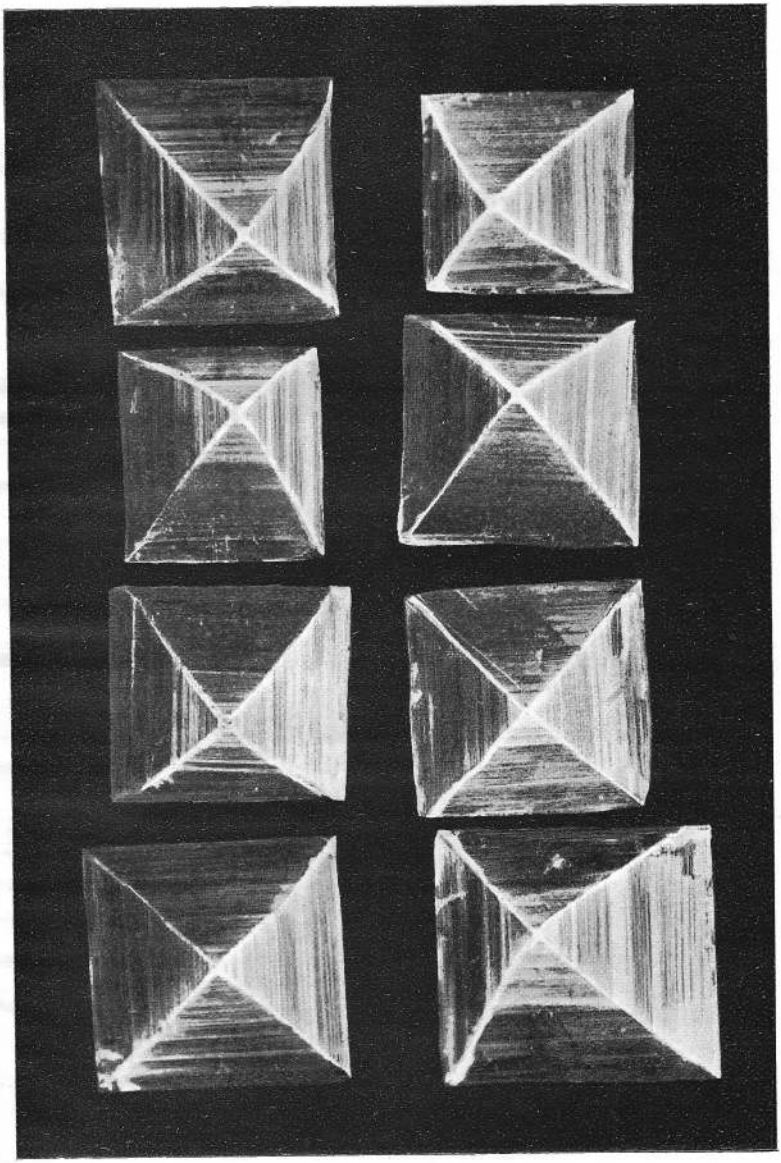

FIG. 4.—SALT CRYSTALS FROM MALDON SALT-WORKS.
(About two-thirds nat. size.)

a brass skimmer. Soon after the water has boiled, salt-crystals begin to form on the surface, in a manner which is most interesting to watch. These crystals (Pl. xxxii) are extremely curious objects—thin, white, shell-like, quadrangular at base, rising in the shape of a pyramid with a truncated cone.[29] In size, they vary greatly—some being as much as two inches square: others, equally perfect, no more than one-eighth of an inch. The form is invariable, but the size seems to be determined at the commencement of crystallization; and, after a crystal has started to form, it does not grow. The gentler and shorter the boiling, the finer and more perfect the crystals: violent boiling breaks them into fragments. Such crystals as these are often called "hopper-crystals" (in French, *trémis*). Maxwell Lyte says[30] that they tend to form only in still brine. It is said,[31] too, that the addition of a small quantity of alum to the brine tends to increase their size, but this is not done, I believe, at Maldon. Finally, those crystals which have formed on the surface are skimmed off and set aside for use as the finest table-salt; those lower down are next taken out and used as pickling-salt; while the residue then left in the pan, being less pure, serves for agricultural purposes. This operation is repeated daily, two pans being boiled, the daily yield of salt being about half a ton, or about eighty tons annually.

This output is, of course, insignificant in quantity when compared with that of the Cheshire and Worcestershire rock-salt industry, amounting to hundreds of thousands of tons annually; but, in respect of purity and attractive appearance, Maldon Crystal Salt is far superior to any other produced in Britain, and this enables it to hold its own on the market. Practically, indeed, it reaches the standard of absolute chemical purity, consisting of common salt (chloride of sodium) with an admixture of no more than 0·383 per cent. of other matter, as the following analysis by Dr. A. H. Hassall shows:—

Maldon Crystal Salt Company's Pure Table Salt.

	(100 parts by weight)
Chloride of Sodium	99·617
Chloride of Magnesium	0·198
Sulphate of Magnesium	0·067
Sulphate of Lime	0·118
Total	100·000

29 A salt-crystal forms the trade-mark of the company.
30 Spon's *Cyclopædia*, ii, p. 1710 (1882).
31 Thorpe's *Dic. of Applied Chemistry*, iii, p. 436.

Dr. Hassall adds that it is absolutely free from "mechanical impurity and . . . contains a remarkably small proportion of the salts of magnesia, lime, etc." In consequence of this unusual purity, it is in demand among medical men for stimulating the action of the heart. A far smaller quantity is required, either for table or pickling purposes, than of the ordinary salt of commerce, and there is an absence of that bitter after-taste so often noticed in the case of ordinary salt and due to impurities. Further, it is almost completely non-deliquescent—infinitely less so than ordinary salt—owing to the much smaller quantity it contains of chloride of magnesium, which greedily absorbs moisture from the atmosphere. In every respect, therefore, Maldon Salt is superior to ordinary salt.

The Maldon Salt is sold in card-board boxes of varying sizes, and priced from sixpence upward, each box bearing the Company's trade-mark, a salt crystal. It is stocked by some of the largest London shops and stores, and is used at some of the leading London restaurants. In appearance it bears little resemblance to ordinary table-salt, being sold, not in powder, but actually *in crystals*. The larger of these naturally get broken, but many small ones are to be found whole among the mass. For use at table, it requires crushing.

Let us hope that the manufacture of salt at Maldon, small though it is, may long continue to flourish.

[The Club is much indebted to Mr. Christy for the blocks and prints of the three plates illustrating this paper.—Ed.]

THE MOSSES OF ESSEX: A CONTRIBUTION TO THE FLORA OF THE COUNTY.

By FRED. J. CHITTENDEN, County Technical Laboratories, Chelmsford.

[*Read February 24th*, 1906.]

THE Moss Flora of Essex is by no means a rich one, since, at present, the list (excluding the Sphagnaceæ, which formed the subject of a previous communication, see Essex Naturalist xiv. (1906) pp. 111-116) includes only about 200 species and sub-species out of a total nearly approaching 600 known to occur within the British Isles. The shortness of this list is due to three principal causes:—

1. The fact that only certain parts of Essex have as yet

been carefully searched. Epping Forest, the district immediately round Chelmsford, the neighbourhoods of Witham, Kelvedon and Saffron Walden are the only parts at all thoroughly explored so far, and even in these some as yet unrecorded species, and especially varieties, will no doubt be discovered. The whole of the eastern coast district in the broadest sense, the Roothings, a large part of North Essex, and the whole of the south from Shoebury to Grays and Purfleet, in which district as the chalk crops up several unrecorded or rare species should be found, have yet to be carefully searched; it is therefore plain that in this direction much remains to be done.

2. The lack of diversity in the soils of Essex is another point of importance, and this, together with the low elevation of the whole of the county, has had a marked effect in lessening the number of species likely to be found, and is a very real cause of a poor Moss Flora.

3. The small rainfall of the county is another real cause not only of a lack of luxuriousness in the growth of the species occurring, but also probably of a smaller number of species being met with than in the west of the country. The arboreal species especially are poorly represented; the trees upon which they usually grow are present, but it is seldom that one finds a moss-grown tree, especially in the neighbourhood of London. This may be due in part to the large amount of acid brought down by the rain in many parts of the county, as Mr. Dymond has pointed out in his paper on "Sulphate of Lime in Essex Soils and Subsoils" (ESSEX NATURALIST, xiv., p. 62).

The fruiting of mosses as a general rule appears to be most abundant where the vegetative development is greatest, and we find, as a rule, much less production of fruit by mosses in Essex than we notice in the moister western parts of the country, where the vegetative growth is more luxuriant. In this connection it is worth noting that a considerable number of those mosses that fail to produce fruit, or that fruit but seldom, frequently form numerous small buds or gemmæ, which are capable of reproducing the plant, as we see in *Tetraphis pellucida*, *Tortula papillosa* and *T. mutica* (the leaves of which, like the last, are frequently covered with numerous round gemmæ), *Orthotrichum lyellii*, *Aulacomnium androgynum*, and to a less extent *A. palustre*, or even reproducing themselves by a piece of leaf which breaks off, as in *Campylopus*

pyriformis, a common moss of the peaty soil of heaths in the county, usually found in tufts covered with the broken leaves.

No species of moss is restricted in its British distribution to Essex, although until recently *Zygodon forsteri* had been found only in this county, at first on a felled tree in Walthamstow at the beginning of the last century; later, on beeches in at least two localities in Epping Forest. It has now been found in two other English counties. It is curious that wherever this moss occurs it is always found in a very scattered fashion, both in this country and on the continent. One would scarcely look for such an alpine species as *Grimmia commutata* in Essex, but Mr. H. N. Dixon found it growing on the roof of a house at Wickham Bishops; perhaps other alpine species may be discovered occasionally in a similar fashion if search is made for them. It was suggested that possibly the spores had been carried by the wind across the North Sea from the mountains of Norway, where the moss is common.

Among species of which there is at present no record for the county, but which should be found here, may be mentioned *Polytrichum urnigerum*, *P. gracile*, *Seligeria paucifolia*, *Ditrichum schreberi*, *Leptodontium flexifolium*, *Encalypta streptocarpa*, *Bryum pendulum*, *B. donianum*, *Mnium stellare*, *Hypnum polygamum*, and *H. lycopodioides*.

Not only is there much to be done in Essex as far as mere species recording goes, but anyone taking up the study of the mosses will find them of much interest in themselves. We have to deal with a series of plants in which the gametophyte generation has reached the fullest development forming the leafy plant, while in all other plants the leafy plant belongs to the sporophyte generation with the sole exception of the nearly allied Hepaticæ. The Musci have followed a line of development of their own, and it has come to an end with the more elaborate of their forms. The manner of obtaining water is full of interest and varies greatly in the different species, affording matter for much study; the form and papillosity of the leaves, the arrangements of lamellæ on the leaf surface, the presence of hair points, etc., are all matters apparently closely connected with the obtaining of an adequate supply of water. The part they play in the economy of Nature, the relation they bear to other forms of life, particularly as formers of soil, and lastly, a subject about which we probably

know least, although of the first importance, the distribution of the various forms according to the soil and situation in which they grow, are among other points of interest. This biological survey should go hand-in-hand with a similar survey of the flowering plants, and the land and freshwater molluscs particularly, but other forms of life should not be ignored. Something has been done in various parts of the world of late on these lines, but nothing so far as I know in Essex.

In the compilation of the following list I have had the kind assistance of, and desire to tender my best thanks to, Mr. W. Cole, through whom I have been able to carefully examine the collections belonging to the Essex Field Club; Mr. A. Gepp, for assistance in consulting the specimens collected by Mr. Forster, now in the Herbarium of the British Museum; Mr. G. Maynard, who kindly compiled a list of mosses collected by Mr. F. Y. Brocas, and now in the Saffron Walden Museum; Mr. W. Sherrin, for the list of mosses collected by himself in Essex; Mr. J. Wheldon, for naming the critical group of *Hypnum* known as *Harpidium*; the Rev. E. N. Blomfield, for additions to the list in the *Victoria History of Essex*; and Mr. H. N. Dixon for lists and much help when in doubt.

The following is a list of the sources from which the information contained in the following list of localities has been derived.

(1) 1724. RAY, JOHN. *Synopsis Methodica Stirpium Britannicum*, Ed. III.
(2) 1800. FORSTER, EDWD. Herbarium in the British Museum, Natural History, S. Kensington.
(3) 1802. SOWERBY, JOHN. *English Botany*.
(4) 1833. HOOKER, SIR J. *English Botany*, Vol. v.
(5) 1836. COOPER, DANIEL. *Flora Metropolitana*.
(6) 1843. SIDEBOTTAM, J. Specimens in Mr. Wilson's Herbarium in the British Museum, Natural History.
(7) 1845. GREENWOOD, A. "Mosses found near Chelmsford" in the *Phytologist*, Vol. II.
(8) 1860-1876. VARENNE, E. G. Collection in the Herbarium of the Essex Field Club.
(9) 1874. BROCAS, F. Y. Collection in the Herbarium of the Saffron Walden Museum.
(10) 1800-1905. BRAITHWAITE, DR. R. *British Moss Flora*.
(11) 1885. ENGLISH, J. T. Exsiccata of the Mosses of Epping Forest, in the Herbarium of the Essex Field Club, also many loose specimens collected in the Forest, mostly near Epping.
1886. ENGLISH, J. T. MS. list of the Mosses of Epping Forest.

(12) 1890. BUXTON, E. N. "Mosses." *Epping Forest*, Ed. III. [This list was made by Mr. English. Ed.]

(13) 1890. HOLMES, E. M. Notes in the ESSEX NATURALIST and some loose specimens in the Herbarium of the Field Club.

(14) 1898. DIXON, H.N. List of North Essex Mosses in the *Journal of Botany*, May, 1898.

1906. DIXON, H. N. MS. list of additional mosses collected in Essex.

(15) 1900. SALMON, E. S. Notes on Essex Mosses in the ESSEX NATURALIST.

(16) 1901. READ, MISS E. Mosses collected near Southend in the Herbarium of the Biological Dept., Technical Laboratories, Chelmsford.

(17) 1903. TURNER, E. E. Mosses collected near Coggeshall, in my own Herbarium.

(18) 1903. SHENSTONE, J. C. *Victoria History of Essex*. Article "Botany."

(19) 1905. SHERRIN, W. R. MS. list of mosses collected in Essex.

The numbers in brackets following the name of a locality in which a moss has been collected correspond with the numbers in brackets in the list of authorities consulted, and indicate the source of the information. Only the first person recording a moss from a certain locality is indicated. The sign ! following a locality indicates that I have examined the specimen upon which the record is based, and the sign !! indicates that I have collected the species in the locality within the past five years.

* This sign prefixed to a species indicates that I have seen fruiting specimens from the county.

The sequence followed is that of the arrangement in the *Students' Handbook of British Mosses*, Ed. II (1904), by H. N. DIXON.

TETRAPHIDACEÆ.

***Tetraphis pellucida** Hedw.

Epping Forest (11)!; Monk Wood (13)!; Theydon Bois (15)!!; nr. Ambresbury Banks (12); nr. Chelmsford (7); Woodham Walter Common (7)!; Little Baddow Common!!

POLYTRICHACEÆ.

***Catharinea undulata** Web. and Mohr.

Epping Forest (11)!; Loughton!!; Mill Green!!; nr. Chelmsford (7); N. Essex (14); Chignal Smealy!!; Little Baddow Common!!; Hazeleigh (13); Braxted (8)!; Felix Hall Shrubbery (8)!; Saffron Walden (9).

*var. *minor* Web. and Mohr.
Epping Forest (11)!; Braxted (8)!

C. angustata Brid.
Wickham Bishops (14).

***Polytrichum nanum** Neck.
On the Forest between Nagg's (Hagger ?) lane and the Windmill (2)!; nr. Snaresbrook and nr. the gravelly ride by the south side of Snaresbrook pond (2)!; Walthamstow (2)!; Epping Forest (11)!; Theydon Road (11)!; Lower Forest (11)!; nr. Chelmsford (7); N. Essex (14); Tiptree Heath (8)!

***P. aloides** Hedw.
Epping Forest (12); Mill Green!!; Galleywood Common (7); gravel pit, Totham (8)!

**var. *dicksoni* Wallen.
In gravel pit, Totham (8)!

***P. piliferum** Schreb.
On the Forest (2)!; Epping Forest (11)!; Theydon (15); Warley Common!!; nr. Chelmsford (7); Danbury!!; Tiptree Heath (8)!; Osea Is. (13).

***P. juniperinum** Willd.
"On the Forest, gravelly soil with the *piliferum*" (2)!; Epping Forest (11)!; gravel pits by the Wake Arms (12); Warley Common (8)!; nr. Chelmsford (7); Woodham Walter Common (8)!; Totham (8)!; N. Essex (14); Saffron Walden (9).

***P. formosum** Hedw.
Epping Gravel pit (6)!; Epping Forest (11)!; Monk Wood (13)!; South Essex (14); Theydon Bois!!; Warley Common (8)!; nr. Chelmsford (7); Chalkney Wood (8)!; Pod's Wood (8)!; Woodham Walter Common (8)!; Wickham Bishops (8)!; N. Essex (14).

***P. commune** Linn.
"On the Forest, very common" (2)!; Epping Forest (11)!; Leyton!!; Theydon Bois!!; nr. Chelmsford (7); Galleywood Common!!; N. Essex (14); Woodham Walter Common (8)!; Saffron Walden (9).

var. minus Weis.
Tiptree Heath (8)!

DICRANACEÆ.

*Archidium alternifolium Schimp.

"On the forest near the great bog near Salter's Buildings" (2)!; in a woody part of the forest near Hagger Lane (2)! The plate in Sowerby's English Botany of this species was drawn from specimens gathered in moist spots upon Epping Forest by Mr. Edwd. Forster. The plate is dated 1st January, 1810.

*Pleuridium axillare Lindb.

Hagger Lane, Walthamstow (2)!; Monk Wood and on banks of a stream crossing the green ride near Debden Slade (13); wood near Inworth Church (8)!; Saffron Walden (9).

*P. subulatum Rabenh.

Epping Forest (2)!; Lower Forest!!; Mill Green!!; Chelmsford (7); Witham (8)!; Braxted (8)!; Saffron Walden (9).

*P. alternifolium Rabenh.

Totham (8)!; Braxted (8)!; Kelvedon (8)!

*Ditrichum homomallum Huepe.

Mile End, Colchester (8)!

Seligeria calcarea Br. and Schimp.

Saffron Walden (9).

*Ceratodon purpureus Brid.

On the Forest (2)!; in gravelly soil on the Forest near High Beach (2)!; Epping Forest (11)!; Warley Common!!; near Chelmsford (7)!!; Galleywood Common!!; Norton Heath!!; Rivenhall (8)!; N. Essex (14); Kelvedon (8)!; Little Baddow Common!!; Osea Island (13); Hatfield Forest (13); Saffron Walden (9).

*Dicranella heteromalla Schimp.

"In a ditch near Snaresbrook Pond" (2)!; near Hale Banks, Walthamstow (2)!; Epping Forest (11)!; Monk Wood, Epping Forest (13)!; Leyton!!; Loughton!!; Theydon!!; Warley Common (8)!; Mill Green Common!!; nr. Chelmsford (7); Linguard Common!!; banks, Woodham Walter (8)!; Little Baddow Common (8)!; Braxted (8)!; Pod's Wood (8)!; Saffron Walden (9).

*D. cerviculata Schimp.

"On the forest near Wanstead Park in a gravel pit" (2)! All the specimens in Mr. Varenne's collection labelled as belonging here appertain to the last species.

*D. rufescens Schimp.

"Side of clay pits, Epping Plain, scarce, easily overlooked from its small size and colour" (11)!

*D. varia Schimp.

Pond near Barnes' Mill. Springfield (7); Kelvedon (8)!; in a field near Newport, Essex (2)!; Saffron Walden (9).

*var. *tenuifolia* Br. and Schimp.

Little Hale Bushes, Walthamstow (2)!

*Dicranoweisia cirrata Lindb.

"On the rails in our garden," Walthamstow (2)!; "on the bottom of an oak tree in a field in Hoe Street, Walthamstow" (2)!; High Beach (11)!!; Moreton (14); nr. Chelmsford (7); Broomfield!!; Kelvedon (8)!; N. Essex (14); Hatfield Forest (13); Saffron Walden (9).

*Campylopus flexuosus Brid.

Epping Forest (11)!; Loughton!!; nr. Chelmsford (7).

*C. pyriformis Brid.

"On the forest not far from Chingford Hatch" (2)!; very uncertain, cropping up in quantities after the felling of timber trees (11)!; Monk Wood (13); Theydon!!; Galleywood Common!!; Linguard Common!!; N. Essex (14); Little Baddow Common (8)!; Wood near Woodham Walter (8)!

C. fragilis Br. and Schimp.

Chantrey Wood (8)!

Dicranum fuscescens Turn.

Epping Forest (12). I have seen no specimens.

D. bonjeani De Not.

"On the forest near Snaresbrook and Hale Banks" (2)!; Epping Forest (11)!; Loughton!!; Mill Green Common!!; Galleywood Common!!; Woodham Walter Common (8)!; Tiptree Heath!!; West Bergholt Heath (8)!

*D. scoparium Hedw.

On the forest (2) ! ; Leyton ! ! ; Loughton ! ! ; Mill Green Common ! ! ; Carpenter's Wood, Southend (16) ! ; near Chelmsford (7) ; N. Essex (14) ; Gt. Totham (8) ! ; Wood near Woodham Walter (8) ! ; Saffron Walden (9).

*var. *orthophyllum* Brid.

Tiptree Heath (8) ! ; wood at Wickham Bishops (8) !

D. majus Turn.

Monk Wood, Epping Forest (13) !

*Leucobryum glaucum Schimp.

On open parts of the forest (2) ! ; Epping Forest (11) ! ; Loughton ! ! ; wood near Warley Barracks (8) ! ; near Chelmsford (7) ; N. Essex (14) ; Tiptree Heath (8) ! ! ; wood near Woodham Walter (8) !

Mr. English recorded this species as in fruit in Epping Forest, but the fruit on all his specimens belongs to *Webera nutans* which was mixed with the *Leucobryum*. In ESSEX NATURALIST, VI. (1881), Mr. Waller, of Tottenham, records the fruiting of this species in the forest. I have seen no fruiting specimen from the county.

FISSIDENTACEÆ.

*Fissidens exilis Hedw.

"In a damp shady place on a clay soil on the forest" (2) ! ; Hangboy Slade, Epping Forest (15) ; Kelvedon Hall Woods (8) !

*F. viridulus Wahl.

N. Essex (14) ; Braxted (8) ! ; Hatfield Forest (13) ; Kelvedon (8) !

*F. pusillus Wils.

Kelvedon (8) ! ; Great Tey (8) !

*F. incurvus Stark.

N. Essex (14) ; Bank near Kelvedon Hall Wood (8) !

*F. bryoides Hedw.

In hedges and woods, Epping Forest, common (2) ! ; Pilgrim's Hatch, Brentwood ! ! ; Galleywood Common ! ! ; nr. Chelmsford (7) ; Boreham ! ! ; N. Essex (14) ; Kelvedon (8) ! ; Coggeshall (17) ! ; Saffron Walden (9).

*F. crassipes Wils.

By side of a ditch, Kelvedon (8)!

*F. adiantoides Hedw.

In a long bog on the forest near High Beach and the King's Oak (2)!; Galleywood Common (7)!!; Hatfield Forest (13)!; Saffron Walden (9).

*F. taxifolius Hedw.

On the Forest (2)!; Hazeleigh (13); Writtle!!; Chelmsford (7)!!; Broomfield!!; N. Essex (14); Braxted!!; Kelvedon (8)!; Coggeshall (17)!; Earls Colne!!; Hatfield Forest (13); Saffron Walden (9).

GRIMMIACEÆ.

*Grimmia apocarpa Hedw.

Nr. Chelmsford (7); wall, Kelvedon (8)!!; wall, Witham (8)!; on the bottom of a tree, Rivenhall (8)!; Saffron Walden (9).

*G. pulvinata Smith.

Walthamstow (2)!; Epping Forest (11)!; wall, Epping (11)!; nr. Chelmsford (7); Broomfield!!; Springfield!!; Chignal Smealy!!; N. Essex (14); Kelvedon (8)!!; Dovercourt (19)!; Hatfield Forest (13); Saffron Walden (9).

G. commutata Hub.

Tiled roof at Wickham Bishop's (14).

Rhacomitrium canescens *var. ericoides* Br. and Schimp.

Tiptree Heath (8)!

TORTULACEÆ.

*Acaulon muticum C. Muell.

On a bank in the lane from Hoe Street to Markhouse Field, Walthamstow (2)!; nr. Chelmsford (7); Saffron Walden (9).

*Phascum cuspidatum Schreb.

Epping Forest (11)!; Walthamstow (2)!; nr. Chelmsford (7)!!; Broomfield!!; N. Essex (14); Kelvedon (8)!; Dovercourt (19)!; Saffron Walden (9).

*var. *schreberianum* Brid.

Nr. Wicken Bonhunt (2)!

*P. curvicolle Ehrh.

Nr. Chelmsford (7); Audley End (10).

*Pottia recta Mitt.
Saffron Walden (9).

*P. heimii Furnr.
Dovercourt (19)!; nr. Manningtree (8)!; Alresford Creek (8)!

*P. truncatula Lindb.
Walthamstow (2)!; Epping Forest (11)!; Norton Heath!!; nr. Danbury!!; nr. Chelmsford (7); Hazeleigh (13); N. Essex (14); Broomfield!!; Writtle!!; Kelvedon (8)!; Tiptree Heath (8)!; Mark's Hall!!; Hatfield Forest (13); Saffron Walden (9).

*P. intermedia Furnr.
On Epping Forest between Hagger Lane, Walthamstow, and the house where the windmill formerly stood (2)!; nr. the great bog by Salter's buildings (2)!; Carpenter's Wood, Southend (16)!; N. Essex (14); Broomfield!!; Kelvedon (8)!

*P. wilsoni Br. and Schimp.
Nr. Wivenhoe (8)!

*P. minutula Furnr.
Westcliff (16)!; Rainsford End, Chelmsford!!; N. Essex (14); Braxted (8)!; Kelvedon (8)!

*P. starkeana Mull.
Kelvedon (8)!; Feering (8)!

*P. lanceolata C. Muell.
On a bank between Quendon and Newport (2)!; Feering (8)!; Kelvedon (8)!; Yeldham (8)!; nr. Chelmsford (7); Saffron Walden (9).

*Tortula pusilla Mitt.
Kelvedon (8)!; Rivenhall (8)!; Saffron Walden (9).

*T. rigida Schrad.
Chalk pits, Purfleet (9)!; near Chelmsford (7).

*T. ambigua Angstr.
Kelvedon (8)!

*T. aloides De Not.
Kelvedon (8)!; near Halstead (8)!; near Yeldham (8)!

[**T. atrovirens** Lindb.

This species is recorded for Essex in the *Victoria History of Essex*, probably on the strength of a specimen so labelled in Mr Varenne's collection; but this is a species of *Pottia*. The record must therefore be considered unconfirmed.]

***T. cuneifolia** Roth.

Near Springfield (7) !; Military Road, Colchester (8) !; near W. Bergholt (8) !; near Wivenhoe (8) !

***T. marginata** Spruce.

Kelvedon (8) !

***T. muralis** Hedw.

On walls, very common (2) !; Epping Forest (11) !; Leyton !! ; near Chelmsford (7) !; N. Essex (14); Kelvedon (8) !!; Stisted !!; Broomfield !!; Dovercourt (19); Saffron Walden (9).

var. aestiva Brid.

Kelvedon (8) !; Nayland (8) !

***T. subulata** Hedw.

Epping Forest (12); near Chelmsford (7); Broomfield !!; N. Essex (14); Wickham Bishops!!; Kelvedon (8) !; Dovercourt (19) !; near Quendon (2) !; near Henham (2) !; Saffron Walden (9).

***T. mutica** Lindb.

Cobbin's Brook (11) !; nr. Chelmsford (7); Rainsford End !!; Writtle !!; Boreham !!; Wickham Bishops (14); Notley (8) !; Kelvedon (8) !; nr. Bures (8) !

***T. laevipila** Schwaegr.

Trees, Walthamstow (2) !; Epping Forest (11) !; Hazeleigh (13); N. Essex (14) !; nr. Chelmsford (7); Pleshey !!; Braxted (8) !; Stisted !!; Kelvedon (8) !; Hatfield Forest (13); Saffron Walden (9).

***T. intermedia** Berk.

Chelmsford !!; Kelvedon Church (8) !!; Little Greenstead Church (14).

***T. ruralis** Hedw.

Tiles, Walthamstow (2) !; on the ground in a gravel pit between Woodford and Chingford Hatch (2) !; N. Essex (14); Kelvedon (8) !; Feering (8) !

T. ruraliformis Dixon.
Dovercourt (19).

T. papillosa Wils.
Witham (14); Wickham Bishops (14)!!; Inworth (8)!

Barbula lurida Lindb.
Sea cliffs, Southend (7).

*B. **rubella** Mitt.
Epping Forest (11)!; on a tree by the side of Blackwall Chase off the Hare and Hounds Inn, Roxwell (7); Inworth (8)!; near Halstead (8)!; Saffron Walden (9).

B. tophacea Mitt.
N. Essex (14).

*B. **fallax** Hedw.
Epping Forest (11)!; nr. Chelmsford (7); N. Essex (14); Broomfield!!; Braxted (8)!; Kelvedon (8)!; Tiptree Heath (8)!; Yeldham (8)!; Dovercourt (19); Saffron Walden (9).
var. brevifolia Schultz.
In a lane between Hall Lane and Grove Lane, Henham (2)!; on a bank between Ugley and Quendon near the 35-mile stone (2)!; Dovercourt (19).

*B. **rigidula** Mitt.
Wall, Little Bardfield (14).

*B. **cylindrica** Schimp.
Nr. Chelmsford (7); N. Essex (14); Yeldham (8)!

B. sinuosa Braithw.
Wickham Bishops (14).

B. hornschuchiana Schultz.
Wall of Colchester Castle (8)!

B. revoluta Brid.
Oyn's Brook Bridge (8)!; Kelvedon Church wall (8)!!; Saffron Walden (9).

*B. **convoluta** Hedw.
On the Forest near Hale End (2)!; in fields near Quendon and Newport (2)!; Saffron Walden (9).

*B. unguiculata Hedw.

On a wall, Greenleaf Lane (2)!; on a wall between Northfields, Hoe Street and the garden of Mr. White's house, Walthamstow (2)!; Epping Forest (11)!; N. Essex (14); nr. Chelmsford (7)!; Kelvedon and Copford (8)!; Dovercourt (19); nr. Quendon (2)!; nr. Rickling (2)!; nr. Widdington (2)!

var. cuspidata Braithw.

Rainsford End, Chelmsford!!; Marks Tey (8)!

var. apiculata Braithw.

On the forest near Hale End and on banks, not uncommon (2)!; near Wicken Bonhunt (2)!

*Weisia crispa Mitt.

Near Chelmsford (7); Kelvedon (8)!; Saffron Walden (9).

*W. microstoma C. Muell.

Inworth (8)!; near Sible Hedingham (8)!

*W. viridula Hedw.

On a bank in a lane leading from Hoe Street to Markhouse field and in the lane leading from Hoe Street to Mr. Biggs', Great House (2)!; Forest near the great Bog (2)!; near Hale End (2)!; Coopersale (11)!; Writtle!!; near Chelmsford (7); Kelvedon (8)!; Saffron Walden (9).

*W. mucronata Br. and Schimp.

Near Halstead (8)!

Cinclidotus brebissoni Husn.

On a tree in the meadows, Widford (8!; Writtle!!; Great Bardfield (8)!

Encalypta vulgaris Hedw.

"Bryum erecta capitulis, calyptra laxa conica, foliis serpilli pellucidis angustioribus. Observed by Mr. Vernon in Essex at Sir Thomas Middleton's House." Mr. Fitch informs me that in Ray's time Sir Thomas Middleton's House was Stanstead Hall. This quotation from Ray's Synopsis, Ed. III., is the only record I am able to find of the occurrence of this species in the county.

ORTHOTRICHACEÆ.

Zygodon viridissimus R. Br.

In my garden, Hoe Street, Walthamstow (2)! ; on a hornbeam, Epping Lower Forest (11) ! ; nr. Chelmsford (7) ; N. Essex (14) ; Hatfield Forest (13) ; Inworth (8) ! ; Rivenhall (8) ! ; Easthorpe (8) ! ; Ugley Holes (2) !

Z. conoideus Hook. and Tayl.

Epping Forest (11) ! ; on a tree, Kelvedon (8) !

Z. forsteri Wils.

On a felled tree in a timber yard at Chapel End, Walthamstow (2) ! (this tree was probably brought from Epping Forest) ; Monk's Wood (13) ; on beeches near the Wake Arms (14).

[**Ulota bruchii** is recorded in the *Victoria History of Essex*, probably on the strength of the specimen so named in Mr. Varenne's collection, but that specimen belongs to the next species.]

***U. crispa** Brid.

On trees and bushes on the forest between Loughton and Debden Green (2) ! ; on an oak, Ongar Park (11)! ; Chantry Wood (8) ! ; near Chelmsford (7) ; Felix Hall Shrubbery (8) ! ; Great Tey (8) ! ; Mile End, Colchester (8) ! ; wood near Colchester (7) ! ; Saffron Walden (9).

Orthotrichum rupestre Schleich.

Saffron Walden (9).

***O. anomalum** *var. saxatile* Milde.

Wall of garden, Walthamstow (2) ! ; on a tree in the meadows, Kelvedon (8) ! ; Feering (8) ! ; tiles on an old barn near Halstead (8) ! ; Roman Wall, Colchester (8) ! ; on a stone by the water in Hatfield Forest (8) ! ; Saffron Walden (9).

***O. leiocarpum** Br. and Schimp.

Walthamstow (2) ! ; near Chelmsford (7) ! ; near Halstead (8) ! ; Saffron Walden (9).

O. lyellii Hook and Tayl.

Epping Forest (14) ; Wickham Bishops (14) ; Felix Hall Wood (8) ! ; tree in a wood at Copford (8) ; wood at Messing (8) !

O. affine Schrad.

On oak and poplar side of Cobbin's Brook (11) ! ; Writtle ! ! ; N. Essex (14) ; near Chelmsford (7) ; Wickham (8) ! ; Kelvedon (8) ! ; Alresford (8) ! ; Hatfield Forest (13) ; Saffron Walden (9).

O. sprucei Mont.

Old pales near the Chelmer, Chelmsford (8) !

[**O. stramineum** has been recorded in the *Victoria History* as occurring in the county, but I cannot find any specimens of the true plant.]

*__O. schimperi__ Humm.

Near Chelmsford (7) ; Kelvedon (8) !

*__O. tenellum__ Br.

Kelvedon (8) ! ; Feering (8) ! ; Pod's Wood (8) ! ; Lyston (8) !

*__O. pallens__ Br.

Ash tree, Kelvedon (8) !

*__O. diaphanum__ Schrad.

Epping Forest, on a beech (11) ! ; Walthamstow (2) ! ; near Chelmsford (7) ! ! ; Writtle ! ! ; Broomfield ! ! ; Rivenhall (8) ! ; N. Essex (14) ; Kelvedon (8) ! ; Hatfield Forest (13) ; Saffron Walden (9).

FUNARIACEÆ.

*__Ephemerum serratum__ Hampe.

On the Forest near the great bog near Salter's buildings (2) ! ; Epping Forest (12) ; N. Essex (14) ; Kelvedon (8) ! ; Braxted (8) !

*_var. angustifolium_ Br. and Schimp.

Broomfield ! !

*__Physcomitrella patens__ Br. and Schimp.

Hazeleigh (13) ; Kelvedon (8) !

*__Physcomitrium pyriforme__ Brid.

Walthamstow (2) ! ; Epping Forest (11) ! ; Plaistow Levels (2) ! ; near Chelmsford (7) ! ! ; Osea Island (13) ; N. Essex (14) ; Kelvedon (8) ! ; river side, Braxted (8) ! ; Saffron Walden (9).

*Funaria fascicularis Schimp.

"On the edge of a ditch running from a spring on the forest between Snaresbrook and Shrub bush" (2) ! ; near Chelmsford (7); Galleywood Common ! ! ; Kelvedon, Langford, etc., on gravel and clay (8) ! ; Halstead (8) !

*F. hygrometrica Sibth.

"In garden, waste ground," Walthamstow (2) ! ; "on a bank in the lane leading from Hoe Street to Markhouse field," Walthamstow (2) ! ; Epping Forest, abundant where fires have been (11) ! ; N. Essex (14) ; near Chelmsford (7) ; Galleywood Common ! ! ; Hatfield Peverel ! ! ; Kelvedon (8) ! ; Dovercourt (19) ; Saffron Walden (9).

*var. *calvescens* Br. and Schimp.

Chelmsford ! !

MEESIACEÆ.

*Aulacomnium palustre Schwaegr.

"On the forest between Chingford Hatch and Woodford Road" (2) ; "near Chingford Hatch with gemmæ" (2) ! ; in the moist parts of the forest, common (11) ! ; Epping Forest (2) ! ; Theydon (15) ; Loughton ! ! ; Warley Common (8) ! ! ; Galleywood Common (8) ! ! ; N. Essex (14) ; N. Weald ! ! ; Linguard Common ! ! ; Woodham Walter (8) ! ; Tiptree Heath (8) ! ! ; West Bergholt Heath (8) !

This moss is a constant companion of most species of *Sphagnum* in the county but appears to fruit but rarely, the only fruiting specimen I have been able to find having been collected by Mr. English in the bog near the Wake Arms.

*A. androgynum Schwaegr.

"In the gravel pits near Forest House and on the bank near Low Leyton" (2) ! ; Epping Forest, frequent in hollows in the trunks of pollard hornbeams (10) ; side of Theydon Road and Hill Hall Wood (11) ! ; N. Weald ! ! ; N. Essex (14) ; Writtle ! ! ; Little Baddow Common ! ! ; Totham, on gravelly banks (8) ! ; inside an old decayed willow trunk, Feering (8) ! ; near Wivenhoe (8) !

This moss is usually found bearing gemmæ ; very rarely in fruit.

BARTRAMIACEÆ.

***Bartramia pomiformis** Hedw.

By the roadside between Woodford Wells and the Bald-faced Stag (2) ! ; Epping Forest (11) ! ; side of the Theydon Road (11) ! ; N. Essex (14) ; near Chelmsford (7) ; Hatfield Peverel (14) ! ! ; Springfield ! ! ; Little Waltham ! ! ; Woodham Walter ! ! ; Great Totham (14) ; Tiptree (14) ; Pod's Wood Lane (8) ! ; Stanstead (2) !

***Philonotis fontana** Brid.

Epping Forest (11) ! ; Theydon Bois and Loughton Road (11) ! ; near Chelmsford (7) ; Galleywood Common (8) ! ! ; West Bergholt Heath (8) !

BRYACEÆ.

***Leptobryum pyriforme** Wils.

N. Essex (14) ; Chelmsford ! ! ; on the brick of a culvert, Feering (8) !

***Webera nutans** Hedw.

Old gravel pits and damp heaths, Epping Forest (11) ! ; Epping Lower Forest (11) ! ; Leyton ! ! Theydon ! ! ; wood near Warley (8) ! ; nr. Chelmsford (7) ! ! ; Woodham Walter Common (8) ! ; Braxted (8) !

**var. longiseta* Br. and Schimp.

Epping Forest (11) !

***W. annotina** Schwaegr.

"In woods, fallow fields, &c., and barren in shady places in the garden, Walthamstow" (2) ! "In this species are a number of red substances like berries in the alæ of the leaves and about the stalk. They first appeared bright green." Edwd. Forster.

Mr. English says "found in damp places in the Stump Road, Epping Lower Forest, fruit scarce," but all the specimens I have seen of his collecting so labelled belong to *W. nutans*.

***W. carnea** Schimp.

Hale End (2) ! ; "on a tree near the great bog on the Forest" (2) ! ; Theydon (11) ! ; Hazeleigh (13) ; pond near Barnes' Mill, Springfield (7) ; Pleshey ! ! ; Kelvedon (8) ! ; Marks Hall (8) !

W. albicans Schimp.
Dovercourt and Wrabness (19).

[**Bryum pendulum** Schimp. is recorded for Essex in the *Victoria History*, but I have seen no specimens. It is a species that should be looked for.]

B. pallens Sw.
N. Essex (14).

*B. **inclinatum** Bland.
Kelvedon and Tiptree Heath (8) !

*B. **pseudotriquetrum** Schwaegr.
" In a bog on the forest between Salter's buildings and the Windmill (now Windmill Cottage)" (2) ! ; Epping Forest (12) ; Ewell Hall, Kelvedon, habitat now destroyed (8) !

*B. **bimum** Schreb.
Bog on Galleywood Common (7) ! ! ; damp place near Kelvedon (8) !

*B. **affine** Lindb.
Cook's wall, Kelvedon (8) ! ; Tiptree (8) ! ; Brightlingsea Common (8) !

*B. **intermedium** Brid.
Coopersale Forest, local (11) ! ; N. Essex (14) : Kelvedon (8) ! ; Bradley Wood (8) ! ; Wrabness (19).

*B. **caespiticium** Linn.
" Under the pump in our garden ", Walthamstow (2) ! ; " on walls and on the ground, common, Walthamstow " (2) ! ; Epping Forest (11) ! ; Kelley's wall, Epping (11) ! ; N. Essex (14) ; near Chelmsford (7) ; Springfield ! ! ; Kelvedon (8) ! ; Pod's Wood (8) ! ; trunks of felled trees Inworth (8) ! ; on culvert, Beckingham (8) ! ; Saffron Walden (9).

*B. **capillare** Linn.
" On a bank in a hedge, High Beach " (2) ! ; Epping Forest (11) ! ; Rifle ball bank, High Beach (11) ! ; Pilgrim's Hatch, Brentwood ! ! ; N. Essex (14) ; near Chelmsford (7) ! ! ; Broomfield ! ! ; Kelvedon (8) ! ; Inworth (8) ! ; Osea Island (13) ! ; Hatfield Forest (13) ! ; Saffron Walden (9).

*B. **erythrocarpum** Schwaegr.
Forest near Hale End (2)!; garden walls, Epping Forest (11)!; N. Essex (14); Broomfield!!

*B. **atropurpureum** Web. and Mohr.
Epping Forest (11)!; near Chelmsford (7); wood near Wickham Bishops (8)!; Kelvedon (8)!; Dovercourt (19); Saffron Walden (9).

*B. **murale** Wils.
Epping, on walls (11)!; garden wall, Rivenhall (8)!; Roman wall, Colchester (8)!; church wall, Kelvedon (8)!

*B. **argenteum** Linn.
"On the forest near Golder's Hill" (2)!; Epping Forest (11)!; Theydon Bois (11)!; N. Essex (14)!; near Chelmsford (7); Kelvedon (8)!; Harwich (19); Saffron Walden (9).

B. **roseum** Schreb.
Near Chelmsford (7).

Minum affine Bland.
Saffron Walden (9).
var. elatum Br. and Schimp.
Bog, Theydon Bois (11)!

M. **cuspidatum** Hedw.
"Among bushes on the forest near Whipp's Cross and elsewhere" (2)!; N. Essex (14); gravel pit near Springfield Gaol (7).

*M. **rostratum** Schrad.
Epping Forest (11)!; Lower Forest!!; N. Essex (14); Chignal!!; Kelvedon (8)!; Felix Hall Shrubbery (8)!; Copford (8)!; Hatfield Forest (13)!; Saffron Walden (9).

*M. **undulatum** Linn.
"Among bushes in Clay Street and in the second field we had in Wood Street when we lived there" (2)!; Epping Forest (13)!; Monk Wood (11)!!; Epping Lower Forest (12); N. Essex (14); nr. Chelmsford (7); Chignal!!; Broomfield!!; Little

Baddow ! !; Woodham Walter Common (8) !; Hazeleigh (13); Kelvedon (8) !; Hatfield Forest (13) !; Saffron Walden (9).

*M. hornum Linn.

"On Ambrs. banks, the old camp near Epping" (2) !; in the woody part of the forest near Hagger Lane in shady places (2) !; Epping Forest (11) !; Monk Wood (13) ! !; Warley Common ! ! ; Pilgrim's Hatch ! !; Norton Heath ! !; Mill Green ! !; N. Essex (14); nr. Chelmsford (7); Danbury ! ! ; Carpenter's Wood, Southend (16) !; Pod's Wood Lane (8); Saffron Walden (9).

M. punctatum Linn.

"On the Forest beyond Loughton" (2) ! !; Epping Forest (11) !; nr. Loughton (11) !; "in Hainhault Forest between Chigwell Row and Bourn Bridge" (2) !; nr. Chelmsford (7); Brook bank, Chedingsell Grange Farm (8) !; Saffron Walden (9).

*M. subglobosum Br. and Schimp.

Epping Forest (11) !; Epping Lower Forest (11) !; Galleywood Common ! !; Woodham Walter Common (7).

FONTINALACEÆ.

*Fontinalis antipyretica Linn.

Epping Forest (11) !; N. Essex (14); nr. Chelmsford (7); Springfield ! !; pond in Allshott's Farm, Kelvedon (8) !

CRYPHÆACEÆ

*Cryphæa heteromalla Mohr.

"On a maple tree in Loughton Street near the small mound that cropes (?) the road" (2) !; near Chelmsford (7); White Notley (8) !; Kelvedon (8) !; on trees near Shortgrove, near Newport (2) !; Saffron Walden (9).

NECKERACEÆ

Neckera pumila Hedw.

Loughton Forest (13); on hornbeams, Epping (7); Saffron Walden, very sparingly (9).

N. complanata Hubn.

Epping Forest, principally on hornbeam and maple (11) ! ; Monk Wood (13) ; N. Essex (14) ; near Chelmsford (7) ; Broomfield ! ! ; Pleshey ! ! ; trees, Prested Hall Wood (8) ! ; Saffron Walden (9).

***Homalia trichomanoides** Brid.

In a thicket near Chingford lane on the Forest (2) ! ; in a wood near a footpath from Hale End to Chapel End (2) ! ; Crane's Brook, Epping Forest (11) ! ; near Chelmsford (7) ; N. Essex (14) ; Kelvedon (8) ! ; Rivenhall (8) ! ; Saffron Walden (9).

HOOKERIACEÆ.

Pterygophyllum lucens Brid.

In a boggy thicket near Warley Common (2) !

LEUCODONTACEÆ.

***Leucodon sciuroides** Schwaegr.

" On the trees in the forest near Chingford Hatch, and elsewhere" (2) ! ; on maple trees, Lower Forest, scarce (11) ! ; nr. Chelmsford (7) ; Hazeleigh (13) ; N. Essex (14) ; Pleshey ! ! ; trees, Messing (8) ! ; Saffron Walden (9).

Antitrichia curtipendula Brid.

" On a tree in the forest between the Ball-faced stag and Muncombe," (Monkhams ?) (2) ! ; Saffron Walden (9).

***Porotrichum alopecurum** Mitt.

Epping Forest (11) ! ; nr. Chelmsford (7) ; N. Essex (14) ; Coggéshall (17) ; Broomfield ! ! ; Kelvedon (8) ! ; near the east pales of Shortgrove, near Newport (2) ! ; Widdington (2) ! ; Chickney (2) ! ; Saffron Walden (9).

LESKEACEÆ.

***Leskea polycarpa** Ehrh.

Side of Cobbins brook, Epping (11) ! ; N. Essex (14) ! ; Writtle ! ! ; Broomfield ! ! ; Kelvedon (8) ! ; Saffron Walden (9).

***Anomodon viticulosus** Hook. and Tayl.

Hale End (2) ! ; Epping Forest (11) ! ; " on a birch in a lane near Nazing Church " (2) ! ; Chelmsford ! ! ;

Broomfield ! ! ; N. Essex (14) ; Chignal ! ! ; Roxwell ! ! ; Little Boyton Hall Farm (7) ; Pleshey ! ! ; Kelvedon (8) ! ; Hatfield Forest (13) ! ; Saffron Walden (9).

Leptodon Smithii Mohr.

"Gathered by Mr. Dillwyn near Walthamstow" (3) ; this specimen was figured in British Botany (1804).

Thuidium abietinum Br. and Schimp.

Saffron Walden on chalk ridges and in chalk pits along with *Hypnum molluscum* (9).

***T. tamariscinum** Br. and Schimp.

"On the forest very common but seldom seen in fruit" (2) ! ; Epping Forest (11) ! ; Loughton ! ! ; Hazeleigh (13) ; near Chelmsford (7) ; Mill Green ! ! ; N. Essex (14) ; Little Baddow ! ! ; Woodham Walter ! ! ; Linguard Common ! ! ; Braxted (8) ! ; Earls Colne ! ! ; Hatfield Forest (13) ; Saffron Walden (9).

HYPNACEÆ.

Climacium dendroides Web. and Mohr.

Near the shore below Southend (2) !

***Pylasia polyantha** Br. and Schimp.

Elm tree, Ewell Hall, Kelvedon (8) !

***Isothecium myurum** Brid.

Epping Forest 12) ; near Chelmsford (7) ; N. Essex (14) ; Little Baddow ! ! ; Kelvedon (8) !

***Pleuropus sericeus** Dixon.

"On the forest" (2) ! ; "principally on elm trunks, especially prostrate ones" (11) ! ; near Chelmsford (7) ! ! ; N. Essex (14) ; Writtle ! ! ; Chignal ! ! ; Braintree ! ! ; Kelvedon (8) ! ; Earls Colne ! ! ; Dovercourt (19) ; Hatfield Forest (13) ; Saffron Walden (9),

***Camptothecium lutescens** Br. and Schimp.

Southend (2) ! ; near Chelmsford (7) ; N. Essex (7) ; Kelvedon (8) ! ; Saffron Walden (9) ; Wicken Bonhunt (2) !

Brachythecium salebrosum *var. palustre* Schimp.

Wrabness (19).

B. glareosum Br. and Schimp.

Saffron Walden (9).

*B albicans Br. and Schimp.

On the forest near Hale End, Walthamstow (2) ! ; near Chelmsford (7) ; Osea Island (13) ; N. Essex (14) ; Maldon (19) ; Danbury ! ! ; Norton Heath ! ! ; Donyland Heath (8) ! ; Wivenhoe (8) ! ; Dovercourt (19) ; Saffron Walden (9).

*B. rutabulum Br. and Schimp.

In a wood near Hale End (2) ! ; Epping Forest (11) ! ; Galleywood Common ! ! ; Chelmsford (7) ! ! ; Prittlewell (16) ! ; N. Essex (14) ; Kelvedon (8) ! ; Inworth (8) ! ; Cressing Temple (8) ! ; Woodham Walter ! ! ; Tiptree Heath ! ! ; Wickham (8) ! ; Saffron Walden (9).

*B. rivulare Br. and Schimp.

Cobbins brook, on prostrate trunks submerged (11) ! ; Hatfield Forest (13) ; Chalkney Wood (8) !

*B. velutinum Br. and Schimp.

Walthamstow (2) ! ; Epping Forest (11) ! ; Coopersale (11) ! ; nr. Chelmsford (7) ; Writtle ! ! ; Broomfield ! ! ; N. Essex (14) ; Woodham Walter ! ! ; Kelvedon (8) ! ; Dovercourt (19) ; Hatfield Forest (13) ! ; Saffron Walden (9).

B. populuem Br. and Schimp.

Saffron Walden (9).

B. plumulosum Br. and Schimp.

Nr. Chelmsford (7) ; Saffron Walden (9).

B. illecebrum DeNot.

" In open parts of Epping Forest " (2) ; Little Baddow Common (7) !

*B. purum Dixon.

" In hedges and in woods, Epping Forest " (2) ! ; Monk Wood (11) ! ; Loughton ! ! ; Ramsden Heath (7) ; Hazeleigh (13) ; Southend (16) ; Galleywood Common ! ! ; N. Essex (14) ; Kelvedon (8) ! ; Broomfield ! ! ; Hatfield Forest (13) ! ; Saffron Walden (9).

Eurhynchium piliferum Br. and Schimp.

Mattham's Lane and Crane Wood, Epping 11) ! ; N. Essex (14) ; Bligh's Wood, Springfield (7) ; Kelvedon (8) ! ; Donyland Heath (8) ! ; Colne, near Wivenhoe (8) ! ; Hatfield Forest (13) ; Saffron Walden (9).

E. crassinervium Br. and Schimp.
Hatfield Forest (13); Saffron Walden (9).

***E. prælongum** Br. and Schimp.
Near Loughton, very common in hedges (2)!; Epping Forest (11)!; Loughton!!; Mill Green Common!!; near Chelmsford (7); Prittlewell (16)!; Hazeleigh (13)!; Osea Island (13); N. Essex (14); Broomfield!!; Pleshey!!; Kelvedon (8)!; Dovercourt (19); Hatfield Forest (13); Saffron Walden (9).

***E. swartzii** Hobk.
Epping Forest (11)!; Hazeleigh (13); Broomfield!!; Kelvedon (8)!; Rickling (2)!; Wicken Bonhunt (2)!; Saffron Walden (9).

***E. pumilum** Schimp.
Kelvedon, Inworth and Aldham (8)!; Hatfield Forest (13).

***E. tenellum** Milde.
Near Chelmsford (7); Inworth, "with slightly scabrous seta" (8)!; Saffron Walden (9).

***E. myosuroides** Schimp.
"On the forest" (2)!; "to such an extent in Epping Forest that sometimes whole trunks are covered with it" (11)!; near Chelmsford (7); Kelvedon (8)!; Saffron Walden (9.)

***E. striatum** Br. and Schimp.
"On banks, very common," Essex (2)!; Epping Forest (11)!; nr. Chelmsford (7)!!; N. Essex (14); Kelvedon (8)!; Chalkney Wood (8)!; Hatfield Forest (13); Saffron Walden (9).

***E. rusciforme** Milde.
Malt Kiln, Epping (11)!; nr. Chelmsford (7)!; Kelvedon (8)!; Stisted!!; Dunmow!!; Saffron Walden (9).

***E. murale** Milde.
N. side of Chingford Church, L. W. Dillwyn (3); Hoe Street, Walthamstow (2)!; Epping Forest (11)!; nr. Chelmsford (7); Springfield Church (7)!; Chignal Smealy!!; Kelvedon (8)!!; Saffron Walden (9).

*E. **confertum** Milde.

Epping Forest (11) ! ; Prittlewell (16) ! ; nr. Chelmsford (7) ; N. Essex (14) ; Chignal Smealy ! ! ; Gt. Braxted (8) ! ; Dovercourt (19).

*E **megapolitanum** Milde.

Kelvedon (8) ! ; Copford (8) !

Plagiothecium pulchellum Br. and Schimp.

Saffron Walden (9).

*P. **denticulatum** Br. and Schimp.

In a wood near Hale End, Walthamstow (2) ! ; Epping Forest (11) ! ; " a variety that occurs on shady banks scarcely ever produces fruit " (11) ; Copt Hall ! ! ; Crane's Wood (11) ! ; Theydon Bois ! ; Mill Green Common ! ! ; Warley Common ! ! ; nr. Chelmsford (7) ; Boreham ! ! ; Broomfield ! ! ; Little Baddow ! ! ; Chantry Wood, Chalkney Wood and Pod's Wood Lane (8) ! ; Norton Heath ! ! ; Hatfield Forest (13) ! ; Dovercourt (19) ; Saffron Walden (9).

var. majus Boul.

Loughton ! !

*P. **sylvaticum** Br. and Schimp.

Mill Green ! ! ; Danbury ! ! ; Chalkney Wood (8) ! ; Epping Lower Forest (11) ! ; Broomfield ! !

P. **undulatum** Br. and Schimp.

Epping Forest (11) ! ; Monk Wood (13) ! ! ; Coopersale (11) ! ; nr. Chelmsford (7).

Amblystegium serpens Br. and Schimp.

" On trees in the Forest " (2) ! ; Epping Forest (11) ! ; nr. Chelmsford (7) ! ; N. Essex (14) ; Broomfield ! ! ; Kelvedon (8) ! ; Copford (8) ! ; Coggeshall (17) ! ; Hatfield Forest (13) ; Saffron Walden (9).

A. **irrigwum** Br. and Schimp.

Hatfield Forest (13).

A. **filicinum** De Not.

Epping Forest (11) ! ; N. Essex (14) ; nr. Springfield (7) ; Queen's Wood, Great Leighs (7) ; Coopersale (11) ! ; Kelvedon (8) ! ; Messing (8) ! ; Braxted (8) ! ; Bergholt (8) ! ; banks of the Colne, Yeldham (8) ! ; Saffron Walden (9).

Hypnum *sub.-gen.* **Campylium**

H. riparium Linn.

"In a pond not far from the back of Paradise Row, Walthamstow" (2)!; "under a bridge nr. the Lea Bridge Road" (2)!; "against a wall in Mr. Todd's horsepond, Marsh Street," Walthamstow (2)!; "on the bank of a brook nr. Shernhall Street," Walthamstow (2)!; Leyton (10); "scarce in gravel pits," Epping Forest (11); nr. Chelmsford (7); N. Essex (14); Springfield!!; Writtle!!; Broomfield!!; waste water near Kelvedon Mill (8)!; in a well, Inworth (8)!; Danbury Common, a somewhat elongated form!!; Saffron Walden (9).

The figure of this species in Dr. Braithwaite's *British Moss Flora* was drawn from the specimen collected at Leyton.

var. longifolium Schimp.

Walthamstow, Epping Forest!!

H. stellatum Schreb.

"In the long bog on the forest beyond the King's Oak" (2)!; nr. Quendon (2)!; nr. Chelmsford (7); Galleywood Common (8)!!; Linguard Common (8)!; West Bergholt Heath (8)!; Saffron Walden (9).

H. chrysophyllum Brid.

Saffron Walden (9).

Sub-genus **Harpidium.**

(In this sub-genus I have had the invaluable assistance of Mr. J. A. Wheldon, the British authority on the group, who has most kindly examined and named all the available specimens. Where specimens do not exist the naming is exceedingly doubtful.)

H. aduncum Hedw.

Nr. Chelmsford (7). (This specimen probably belongs to *H. exannulatum.*)

Group *Typicum* Ren.

var. falcatum Schimp.

Kelvedon (8)! This specimen is almost midway between var. *falcatum* and var. *aquaticum* J.A.W.

var. aquaticum Sanio.
Kelvedon (8) !
Group *Kneiffii* Ren.
N. Essex (14) ; Loughton Forest (13).
var. polycarpon Bland.
Norton Heath ! !
var. intermedium Schimp.
Norton Heath ! !
Group *pseudo-fluitans* Sanio.
var. paternum Sanio.
Kelvedon (8) ! ; High Easter ! !

H. fluitans Linn.

The following in the absence of specimens cannot be placed ; some may belong to the next species.
Thomas Warner's gravel pit in the Forest near Woodford Row (2) ; "pond in Greenleaves Lane," Walthamstow (2) ; in Walthamstow Marshes (2) ; nr. Chelmsford (7) ; N. Essex (14) ; Saffron Walden (9).
Group *Amphibium* Ren.
var. jeanbernati Ren.
Loughton ! ! ; Warley Common ! !

H. exannulatum Gumb.

"Scarce, Epping Forest " (11).
Group *Typicum* Ren.
var. pinnatum Boul.
Cuckoo Pits, Chingford ! ! ; Tiptree Heath (8) !
var. pinnatum forma *stenophylloides* Ren.
Epping Forest in a gravel pit (11) ! ; Epping Forest (19) ; nr. the Earl's Path, High Beach ! ! ; nr. the Rising Sun, Walthamstow ! ! ; Norton Heath ! ! ; Mill Green Common (approaching the var. *brachydictyon.* —J.A.W.) ! !
var. brachydictyon Ren.
Norton Heath ! ! ; Galleywood Common (8) ! ! ; West Bergholt Heath (an extreme form diverging strongly towards var. *pinnatum*, due to the less alpine habitat. J.A.W.) (8) !
var. molluscum Sanio.
Leyton, Epping Forest ! !

Group *Rotae* Ren.

var. * *falcifolium* Ren.

"Nr. the Menyanthes Bog, Epping Forest" (2)!; Epping Forest (11)!; Warley Common (8)!; Tiptree Heath (8)!!; Galleywood Common (an unusually dwarf form but I have a similar form from Derbyshire. J.A.W.)!!

var. falcifolium forma *heteroptera* Ren.

High Beach, submerged in a gravel pit, and at Walthamstow in a similar locality!!

This is a somewhat puzzling form, which Mr. Wheldon submitted to Mons. Renauld, who coined the name for it. M. F. Renauld says, regarding it, "Cette forme ne se classe pas facilement dans les groupes admis. C'est un fait qui produit rarement; mais cependant qui se produit et j'en ai eu d'autres examples. La couleur est cette des formes boreales du group *falcatum*, la forme des feuilles la nervure forte et tres longue et les cellules moyennes longues sont du group *Rotae*; mais les oreillettes sont peu developees, mal separees, presque comme dans le group *amphibium*, et nullement caracteristiques. C'est cette derniere particularite qui rend le classement difficile et incertain. Nous sommes donc en presence d'une forme accidentelle, curieuse, mais sous importance par son cas isole, par suite de la structure des oreillettes, qui est en accord avec les autres caracteres on pourrait la nommer (avec un point de doute) *H. fluitans* (*Rotae*) var. *falcifolium*, forma *heteroptera*."

***H. uncinatum** Hedw.

Tiptree Heath (8)!

H. commutatum Hedw.

Hickmore Fen Wood (8)!; "in a bog in a marshy meadow nr. Tuddington Parsonage, 1792" (2)!

H. falcatum Brid.

Linguard Common (8)!

[*H. intermedium* Lindb.

This species is recorded for Essex in the *Victoria History*, but that record is probably based on the specimen so named in Mr. Varenne's collection, which

proves on re-examination to belong to *H. falcatum*. This species must for the present therefore be expunged from the list.]

Sub-genus **Drepanium**

H. cupressiforme Linn.

An exceedingly abundant and very variable species.

On trees in the forest very common (2)!; "on forest near the bog and near the gravel pits" (2)!; wood, near Hale End (2)!; Epping Forest (11)!; Monk Wood (13); Leyton!!; Theydon!!; Carpenter's Wood, Southend (16)!; N. Essex (14); Chelmsford (7)!!; Norton Heath!!; Mill Green!!; Kelvedon (8)!; Hazeleigh (13); Chauntrey Wood, Witham (8)!; Tiptree (8)!; Feering (8)!; Hatfield Forest (13); Saffron Walden (9).

var. resupinatum Schimp.

"In a wood near Hale End, Walthamstow" (2)!; on the Forest (2)!; N. Essex (14); Hatfield Forest (13); nr. Quendon (2)!; Mill Green!!

var. filiforme Brid.

"Trunk of a tree, Epping Lower Forest" (11); Saffron Walden (9).

var. ericetorum Br. and Schimp.

N. Essex (14); Tiptree (8)!

var. elatum Br. and Schimp.

Maldon (19).

H. molluscum Hedw.

Epping Forest, Theydon and Coopersale. This pretty moss cropped up after the lopping in quantity: the third year after it had entirely disappeared (11)!; nr. Chelmsford (7); Rivenhall (8)!; Hatfield Forest (13); Saffron Walden (9).

Sub-genus **Calliergon.**

H. stramineum Dicks.

Walthamstow, near the Rising Sun; a very curious form (♀) differing from the fell plant of the North of England in its loosely arranged, less appressed leaves!!; Woodham Walter Common (8)!; West Bergholt Heath (8)!

H cordifolium Hedw.

Epping Forest (11)!; margin of the Wake Valley Pond!!; Thrift Wood and Wood by the Ship Inn, Galleywood (7); Wood near Totham (8)!

[*H. giganteum* Schimp.

This species has been recorded for the county in the *Victoria History*, but all the specimens I have seen collected in Essex and so labelled have proved to belong to the preceding species. The record needs confirmation.]

***H. cuspidatum** Linn.

"In the great bog near Salter's Buildings and the old Windmill, Epping Forest" (2)!; Epping Forest (11)!; Loughton!!; clay pit by Styles, Epping Forest (11)!; Norton Heath!!; nr. Chelmsford (7); Writtle!!; N. Essex (14); Danbury!!; Tiptree Heath!!; Kelvedon (8)!; clay pit near Felix Hall (8)!; Hatfield Forest (13)!; Saffron Walden (9).

H. schreberi Willd.

"In a hedge, Loughton and elsewhere, not uncommon" (2)!; Epping Forest (11)!; Loughton!!; Mill Green!!; nr. Chelmsford (7); Galleywood Common (8)!; N. Essex (14); Woodham Walter Common (8)!!; Tiptree Heath (8)!!; Saffron Walden (9).

Hylocoimum splendens Br. and Schimp.

Hale End (2)!; Epping Forest, very scarce (11)!; Monk Wood (13)!; Epping Lower Forest (11)!; Tiptree Heath (8)!; Saffron Walden (9).

H. loreum Br. and Schimp.

Hatfield Forest (13).

H. squarrosum Br. and Schimp.

On the Forest (2)!; nr. Hale End (2)!; Epping Forest (11)!; Loughton!!; Ramsden Heath (7); Mill Green!!; N. Essex (14); Tiptree Heath (8)!; Chauntrey Wood, Witham (7); Hatfield Forest (13); Saffron Walden (9).

*H. triquetrum Br. and Schimp.

On Forest, very common (2) ! ; Loughton (2) ! ; Epping Forest (11) ! ; nr. Chelmsford (7) ; N. Essex (14) ; Chalkney Wood, Earls Colne (8) ! ; Saffron Walden (9).

[The Club is greatly indebted to Mr. Chittenden, not only for collating the information concerning the Museum Herbaria of Mosses, and identifying doubtful examples, but also for actually mounting and arranging the specimens. Mr. Chittenden's work in this way has been of the highest Museum value and a great aid to the Curator.—ED.]

ON THE SALINITY OF THE SEA-WATER ALONG THE COAST OF ESSEX.

By H. C. SORBY, LL.D., F.R.S., F.L.S., F.G.S., &c.

[*Read October 27th*, 1906.]

FOR a number of years (1884 to 1888, both inclusive) I systematically studied the salinity of the water along the coast and in the estuaries of Essex, and found that one of the most important facts in connection with the distribution of the marine animals was the difference between the density of the high and low water. My results, however, apply only to the summer months, from the early part of May to the latter end of September ; and no doubt they differ widely from the conditions in winter. The comparative salinity was determined by a hygrometer, which was far the most convenient method on board a yacht.

What struck me much was that in some years at Burnham on-Crouch the density of the low water was greater than at high water ; and, in passing up the river to Battles Bridge, the density became greater and greater. To my surprise I found the well-marked Alga, *Chorda*, growing in some quantity not much below Battles Bridge in 1885, when the density of the water was very high, but I looked for it in vain in 1885, when the density was much lower. I do not remember seeing it elsewhere along the coast of Essex. This excess in density in

particular years is, of course, easily explained by greater evaporation and smaller rainfall.

I have observed similar facts at Paglesham and West Mersea, but not in Brightlingsea Harbour and the adjoining creeks, or in Harwich Harbour and up the Stour.

It thus appears that, at all events in the summer of certain years, the water in some of the Essex estuaries is even more salt than the water outside coming in with the high tide. Along the coast of Essex in summer the sea-water is also somewhat more dense than that of the contiguous part of the North Sea.

The following table shows the mean densities of the water in summer off the coast, and at high and low water in the estuaries, and the differences, plus or minus, of the low water compared with the high. As will be seen, these differences, though not great, are well marked. It will also be observed that, at all events in summer, the water in the estuaries would be very suitable for the purposes of salt-making by evaporation.

	High.	Low.	Difference.
Burnham, 1885	26·37	26·76	+ ·39
„ 1888	25·92	24·36	− 1·56
Near Battles Bridge, 1885	27·24		
„ 1888	22·33		
Paglesham	25·36	24·92	− ·45
„ 1885	26·45	27·28	+ ·83
West Mersea, 1886	26·19	26·54	+ ·35
Brightlingsea Harbour	25·90	25·07	− ·83
Pyefleet, mean	25·86	23·86	− 2·00
„ 1885, maximum	26·27		
Harwich Harbour	25·66	25·18	− ·48
Open water off the coast, mean ...	26·53		

N.B.—All these numbers refer to the excess of density above rain water, reckoned as 1000. Thus, in the case of the first item in the above list, I give 26·37 instead of 1026·37, which shows the effect of the salts more distinctly, independent of the weight of the water.

THE CORRESPONDING SOCIETIES' COMMITTEE OF THE BRITISH ASSOCIATION, YORK, 1906.

REPORT OF THE CLUB'S DELEGATE,

F. W. RUDLER, I.S.O., F.G.S., *Secretary of the Conference of Delegates.*

[*Read November 24th*, 1906.]

AT the first meeting of the Delegates held under the chairmanship of Sir Edward Brabrook, C.B., who fitly represented the new group of "Associated Societies," the chief subject for discussion was that of Meteorology. Dr. H. R. Mill, the distinguished authority on rainfall, introduced the subject by an admirable address, in which he commended the study of meteorology as one peculiarly fitted for cultivation by provincial societies, inasmuch as it needed for its prosecution comparatively simple appliances, whilst it developed habits of strict accuracy and method in the observers. At the same time it contributes to the advancement of knowledge in directions much needed. The determination of local climate can be best effected by the work of local societies, since it requires long continuous records usually beyond the power of individual observers. Dr. Mill remarked that a society should be, by its nature, immortal—a remark which, it is hoped, may be applied to the Essex Field Club. But as our Club does not contemplate the formation of a meteorological station the subject need not be enlarged upon.

Of more direct interest to the Club were the proceedings at the second meeting. This was held under the chairmanship of Mr. John Hopkinson, for many years the honorary secretary of the Hertfordshire Natural History Society, and was attended by the President of our Club. The main subject of discussion at this meeting was that of County Photographic Surveys, which was introduced by Mr. W. Jerome Harrison, of Birmingham. In an elaborate paper Mr. Harrison traced the history of the survey movement, which was really initiated by him, when, in 1889, he proposed a photographic survey of Warwickshire. From Warwickshire the work has spread, and surveys are now in active operation in Worcestershire, Kent, Surrey, Yorkshire, and Edinburgh, as well as in Essex. Mr. Victor Taylor had kindly sent your delegate some notes on the photographic survey of Essex, which he used. Mr. Harrison

advocated the appointment of a Committee, which should (1) collect details as to the exact work already accomplished, (2) circulate printed matter making the aims and methods of the surveys widely known, (3) endeavour to co-ordinate the photographic societies on the one hand, and the literary and scientific societies on the other, so that all may unite in the work of the survey, (4) obtain lists of experts willing to advise on details of the work, and (5) secure the publication of series of prints dealing with either districts or subjects.

The delegates who were present warmly supported Mr. Harrison's project, and it was proposed to secure, if possible, at next year's meeting of the British Association at Leicester, the appointment of a County Photographic Committee. It may be noted that in the course of the discussion Dr. H. H. Turner, F.R.S., professor of astronomy in the University of Oxford, pointed out the desirability of taking photographs on stereographic principles, for use in making a ground-plan of the objects photographed as explained in the *Monthly Notices of the Royal Astronomical Society* for December, 1901, p. 126.

SEA BREAM IN ESSEX WATERS.

By JAMES MURIE, M.D., LL.D., F.L.S.

SO far as I am aware there is no record of the Sea-Bream (*Pagellus centrodontus*) having been met with strictly within Essex waters. Dr. Laver does not mention it in *The Mammals, Reptiles and Fishes of Essex*,[1] or in his additions since in the *Victoria History*, Vol. I.

Neither to my knowledge is it included in any of Mr. E. A. Fitch's lists of captures in his various notes in several volumes of the ESSEX NATURALIST. The above two naturalists being reliable authorities on our local fish-fauna, their silence doubtless betokens absence of information thereon. I have, however, been fortunate enough to obtain a true Essex example, inasmuch as it was obtained within half a mile of low-water mark.

The fish in question was caught by one of our Leigh white-baiters, Harry Johnson (best known by nickname—"Roughy"), on 5th November last (1906). He and his mate were then using the stow-net, between the Crow Stone and the end of

1 *Special Memoirs of Essex Field Club*, Vol. III.

Southend Pier, in water about three fathoms deep. The fish was new to them as others of fishermen at work hard by. When fresh caught its brilliant silvery scales immediately attracted attention. According to the men its head and dorsum were only slightly tinted with pale orange pink, the silvery hue visibly predominating. Such certainly was the case when brought to me. Moreover, it was destitute of the black shoulder patch so specifically characteristic of the full-grown *Pagellus centrodontus*.

Extreme length, 9¼ inches. It barely turned the scale at ½lb. weight. Greatest depth of body just behind the pectoral fin 2·9 inches. Eye ⅕ths of an inch in diameter. Sex doubtful. Food, quite a number of young of the Greater Pipefish (*Sygnathus acus*) ranging from 2¼ to 3¼ inches in length; also a post-larval Butterfish or Gunnell (*Centronotus gunnellus*) 38 mill. = 1½ inches long.

This Essex specimen of immature Sea Bream (yearling or thereabouts) seems to come under what are known by the local name of "Chad" by the Devon and Cornwall fishermen. Theirs is an indefinite term for the young bream of various sizes destitute of the adult's dark-coloured shoulder mark and deep orange hue of the dorsum. Our estuary example may have been a straggler from a roving squad; for in their immature stages during the autumn months they crowd in shoals among the inshore shallows of the above counties, whereas the older bream are stated to keep to deeper water and more rocky grounds.[2]

The species in question may be said to have its headquarters quite within the western area of the English Channel. At times it is plentiful and exposed for sale in the fish-marts of Plymouth and Brixham.[3] There seems to be a gradual diminishment in numbers, proceeding eastwards, up channel. For example, on the Sussex coast,[4] they are relatively fewer, and still less so around Kent, which, indeed, somewhat resembles Essex in paucity of their visits. On the Suffolk and Norfolk seaboards they are now seldom caught.[5]

It was originally intended that the specimen of Thames Estuary Sea Bream should have been exhibited to the members

2 Wilcocks, *The Sea Fisherman*, 3rd Ed. (1875), p. 189.
3 Houghton, *Commercial Sea Fishes* (1884), p. 100.
4 Yarrell, *British Fishes*, 3rd Ed., Vol. II., p. 147; also Merrifield, *Natural History of Brighton* (1869), p. 112.
5 Patterson, "Fishes of Great Yarmouth," *Zoologist*, 1897, p. 544.

of the Club on the reading of this paper, and afterwards deposited in the Essex Museum of Natural History. As it happened, Mr. Boulenger, of the British Museum, requested it for the National Collection, where it can now be consulted by those interested.

P.S.—Since this paper was in type, on comparing the description here given with the preserved specimen in the British Museum, there is a distinctly appreciable, but rudimentary, condition of dark spot behind the upper part of the operculum. It consists of some five pigmentary serrations above, and as many below, the commencement of the lateral line. Mr. Boulenger remarks that he has previously observed spirit immersion bring out markings barely visible in the fresh condition of other kinds of fish.—J.M.

The Daffodil Fly in Essex.—This fly, *Merodon equestris*, appears to be spreading in Essex and likely to become a pest of economic importance in the county as a destroyer of daffodil bulbs. The fly, a Dipteron, belonging to the Syrphidae, appears in May, and is exceedingly bee-like, having its abdomen, as a rule, covered with foxy hair, but very variable both in size and coloration. When flying it emits a very shrill sound and has the habit characteristic of many of the Syrphidæ of remaining poised in the air for a time, and then of suddenly darting a distance of about a yard away. It lays its eggs near the base of the daffodil leaves, and the grub hatching in July eats its way into the bulb, afterwards making a hole to the outside through the side or base of the bulb, through which it can dispose of its ejectment. The grub, which is legless, and dark gray or blackish in colour, reaches a length when full grown of about ¾-inch. It turns into a black pupa in November, in those cases I have had an opportunity of examining, outside the bulb in the soil. The only means of dealing with the pest appears to be to wait until October is well advanced before planting the bulbs and then to reject and burn all those that feel soft owing to the eating away of the interior of the bulb.

FRED. J. CHITTENDEN, *Biological Laboratory, Chelmsford.*

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